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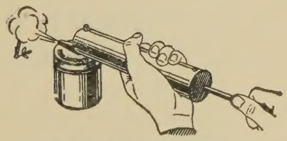

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Furukawa (M.). **Studies on *Attagenus piceus* Oliv., a Pest of raw Silk. 2.** [*In Japanese.*]—*Bull. Raw Silk Insp. Sta.* **2** no. 1 pp. 1–108. Yokohama, 1939.

Further observations on *Attagenus piceus*, Ol., which attacks raw silk in Japan [*cf. R.A.E.*, A **23** 209], showed that at constant temperatures this Dermestid completes a generation in 6 months or 1, 2 or 3 years, depending on nutrition [*cf.* **26** 568]. When fed on dried pupae of the silkworm [*Bombyx mori*, L.], most individuals completed the life-cycle in a year, though a few did so in 6 months. When the medium was dried fish, there was usually one generation a year, but development occasionally lasted 2 years. For examples fed on silkworm cocoons, the life-cycle was usually completed in 2 years, but in some cases it lasted 1 or 3 years. Very few larvae gave rise to adults when fed only on the silk of cocoons and not on the pupae within, and none did so when they were fed on silk cloth or raw silk.

The optimum temperature seems to be about 25°C. [77°F.]. Oviposition under natural conditions occurs mostly from late May to late June, and from late August to October when there are 2 generations a year. The egg stage lasted about 8 days at 25°C. and about 6 days at 28° [82·4°F.], and the larval stage averaged 80 days when there were 2 generations a year and 298–353 when there was only one. At 25, 28 and 30°C. [86°F.], the durations of the larval stages were 65–120, 55–110 and 85–130 days when the life-cycle lasted 6 months; and 603–784, 634–698 and 627–647 when it lasted 2 years; at 25 and 28°C. it was 259–472 and 244–403 days when there was one generation a year.

Cottier (W.) & Clark (P. J.). **Arsenical and Lead Residues on Cabbages.**—*N.Z. J. Sci. Tech.* (A) **21** no. 1 pp. 14a–23a, 3 refs. Wellington, N.Z., 1939.

Owing to the necessity for applying insecticides to cabbages for the control of *Pieris rapae*, L., in New Zealand, investigations were made in 1935–36 on the arsenical and lead residues left at harvest after various spray and dust programmes [*cf. R.A.E.*, A **24** 330]. The sprays used were chiefly suspensions of 2, 3 or 4 lb. lead arsenate or 2 lb. calcium arsenate in 100 gals. water with a neutral spreader, while the dusts comprised mixtures of 1 part by volume lead or calcium arsenate and 5 or 10 parts hydrated lime. The analyses of the insecticides and a brief account of the technique employed in determining the residues are given. The arsenical residue on cabbage sprayed 3 times within 32 days with 2 lb. lead arsenate exceeded the tolerance of 0·01 grain arsenic trioxide per lb. on the whole cabbage 6 weeks after the last spray in some cases, but that on the heart only was below the tolerance 5 weeks after 3 applications on the same dates of 4 lb. lead arsenate and 3 weeks after 6 applications of 2 lb. at intervals of 1–2 weeks.

The residues 5–7 weeks after 3–4 applications in 31–44 days of the stronger dusts at 25 lb. per acre were below the tolerance on hearts, but above it on the whole plant in some cases. The residues from dusts on both whole plants and hearts were greater 3 weeks after application, and smaller 6 weeks after, than those from sprays containing the same weights of lead arsenate or calcium arsenate. With both sprays and dusts, the residues were smaller from calcium arsenate than from lead arsenate. The edible portions of cauliflower plants sprayed 3 times with lead arsenate at intervals of approximately

12 days in May bore practically no residue when harvested in the following spring.

The lead residue on the whole cabbage was less than 0·018 grain lead per lb. (the tolerance in the United States) 4 weeks after not more than 4 sprays containing 2 lb. lead arsenate at intervals of 7–15 days, and on the heart 2–3 weeks after 6 applications at the same intervals. The residues on the hearts of cabbages that had received 4 applications at intervals of 2–4 weeks were below tolerance 2–3 weeks after spraying with 2 lb. lead arsenate, but above it in some cases after dusting with an equal weight of the arsenical. The residues on whole plants were above tolerance.

COTTIER (W.). **Work on Insecticides against the Cabbage White Butterfly,** *Pieris rapae* **L.**—*N. Z. J. Sci. Tech.* (A) **21** no. 1 pp. 23a–45a, 5 refs. Wellington, N.Z., 1939.

An account is given of investigations carried out in New Zealand in 1934–37 on the control of *Pieris rapae*, L., on cabbage. The earlier experiments have already been noticed [*R.A.E.*, A **24** 329], and the later ones largely confirmed the results obtained. The work as a whole showed that lead or calcium arsenate at a concentration of 2 lb. per 100 gals. water plus a spreader gives excellent control of the larvae if applications are made with sufficient thoroughness. Lead and calcium arsenate dusts were definitely inferior to sprays containing the same amount of arsenate per acre, but dusts of 1 part lead or calcium arsenate with 5 parts by volume of hydrated lime proved capable of giving satisfactory control. Dusts of calcium arsenate and lime were the more suitable for application owing to the relative lightness of the arsenate, so that for the same weight of arsenate a bulkier dust, which covered better, was secured. Derris sprays and dusts, at least when fresh, gave excellent control. Some of the derris spray materials had markedly deteriorated in killing-power in their second season, but one that was at least two seasons old when bought, the date of manufacture being unknown, gave good results ; and another, although it also contained pyrethrum extract, gave good results after storage for three seasons. On the other hand, all derris dusts of 0·75 per cent. rotenone content retained their killing-power well. In the field, these derris dusts gave a very good control of the larvae when applied at the rate of 20–25 lb. per acre.

A point to be considered in connection with dusts is that they should be uniformly fine and of sufficient bulk per pound weight to give good cloud-forming qualities, so that an acre can be covered well with 20–25 lb.

GIRAULT (A. A.). **Descriptions of some Chalcid Wasps.**—*Qd Nat.* **11** no. 1 pp. 14–23. Brisbane, 1939.

The new Chalcidoids described in this paper from various parts of Australia include *Gyrolasella margiscutellum*, *G. iphigenia*, *G. iphigenia* var. *hyacinthus* and *Anagyropsis smaragdus* from eggs of *Gonipterus* ; *Coccophagus clariscutellum*, Gir., var. *fasciafacies* from *Aspidiotus perniciosus*, Comst., on plum ; *Dinoura apiomorphae* from galls of *Apiomorpha* ; *Coccophagus horatii* from *Eriococcus* on *Eucalyptus* ; *Coccophagoides aurithorax* from unidentified Coccids ; *Physcus atrithorax* from *Ceroplastes rubens*, Mask., on *Eugenia* ; *Eupelmus grayi*, Gir., var. *brevicinctus* from *Agromyza phaseoli*, Coq. ; *Mesastymachus* *keatsi* from *Austrotachardia* (*Tachardia*) *melaleucae*, Mask.; and *Eupelmus fuligispina* from the eggs of *Ochrogaster contraria*, Wlk.

DINULESCO (G.). **Bemerkungen über die Biologie einer Motte *Dysmasia parietariella* H. S., welche die Selchwaren angreift.** [Observations on the Biology of a Moth, *D. parietariella*, attacking Sausage Goods.]—*Z. Fleisch- u. Milchhyg.* **49** pp. 23 *et sqq.* (repr. 5 pp.) Berlin, 1938. [Recd. 1939.]

An infestation by *Dysmasia parietariella*, H.-S., in a sausage factory in Bucharest in 1935 led to investigations on the life-history and habits of this Tineid, all stages of which are briefly described. The author concludes from breeding experiments that it has two generations a year and overwinters both in the egg stage and in the third larval instar. Overwintered larvae pupated in spring, and adults were numerous in May–June and again in September–October. The pupal stage lasted 15–28 days and adults survived for 20–43 days. There was considerable mortality among larvae brought into the laboratory from the drying rooms.

Of 10 tons of sausages in stock, over 60 per cent. were infested. The eggs were laid in the cracks in the woodwork of the drying rooms, and the larvae fed on rotten wood or on moulds on the walls. Those on the beams from which sausages hung for drying travelled down the strings to the sausages and sought to establish themselves in the folds on the casings, spinning a silken envelope there. At first they fed on the salts and other substances that form a white coating on the surface of the sausages and then they attacked the casings, gnawing deep grooves, which they filled with excreta. Finally they reached the meat. Infestation did not recur after the factory had been thoroughly cleansed. The old woodwork was removed, wooden fittings were replaced by iron ones, and the walls were whitewashed.

The Silver Fish and Firebrat.—*Econ. Leafl. Brit. Mus.* (*Nat. Hist.*) no. 3, 4 pp., 2 figs. London, 1939. Price ½*d.*; 100 copies 2*s.* 6*d.*

Brief notes are given on the appearance and habits of *Lepisma saccharina*, L., and *Thermobia domestica*, Pack. [*cf.* *R.A.E.*, A **14** 543; **26** 224, etc.]; both occur in houses in England, but neither is of great importance as a pest there. *Thermobia* is found chiefly in bakehouses, where the temperature is consistently high. Females of *Lepisma* lay 7–12 eggs, and those of *Thermobia* considerably more. These insects develop slowly; the incubation period, which varies with temperature and other factors, lasts from 6 to over 60 days, and the nymphs do not mature in less than 20 months.

Control is best obtained by means of baits scattered where the insects occur and blown into neighbouring crevices with bellows. Suggested formulae are sodium fluoride and flour (1 : 6 parts by bulk) or sodium fluoride, pyrethrum powder and corn starch (6 : 2 : 2), but they are very dangerous to use in bakehouses. Spraying with domestic insecticides containing pyrethrum is also often effective.

TRÄGÅRDH (I.). **Sveriges Skogsinsekter.** [The Forest Insects of Sweden].—Med. 8vo, 2nd Edn., xii+509 pp., 570 figs., 5 pp. refs. Stockholm, Hugo Gebers Förlag, 1939.

This second edition of the author's monograph on the forest insects of Sweden [*R.A.E.*, A **3** 47] embodies the results of much work that has been carried out in the last 25 years. Some insects formerly considered to be pests have proved to be without economic significance, while others, about which little was previously known, have been shown to cause considerable damage. Accordingly, information is included on about 60 insects not dealt with in the earlier edition, and 30 have been omitted. The arrangement of the book is largely unchanged, but the text has been considerably expanded and rewritten, and many new figures have been added. The concluding chapters comprise discussions of the various types of injury that insects cause to forest trees, factors leading to a mass increase of insect populations, methods of diagnosing incipient outbreaks and studying their progress, and forest measures and other methods of control, including biological methods. A brief chapter is appended on insects that damage timber in buildings.

Golfari (L.). **Ricerche sull'etologia della** *Cydia* (*Laspeyresia*) *pomonella* **L. in rapporto coi mezzi usati per combatterla.** [Investigations on the Habits of *C. pomonella* in Relation to the Means used for its Control.]—*Boll. Inst. Ent. Univ. Bologna* **11** pp. 41–63, 1 fig., 1 pl., many refs. Bologna, 1939.

Investigations were carried out in northern Italy in 1937–39 on the habits of newly hatched larvae of *Cydia pomonella*, L., on apple, and the way in which they are poisoned by lead arsenate. In this region the moth has two overlapping generations a year, and eggs were observed continuously from May to September. Females of the overwintered generation oviposited chiefly on the leaves and those of the summer generation mainly on the fruit. Of first-generation eggs, 74, 4 and 22 per cent., respectively, were laid on leaves, twigs and fruit. On pear, the percentages on the fruit were larger. Females of the overwintered generation began to oviposit on the second day after emergence and continued to do so for 1–2 weeks. Those of the summer generation began to oviposit on the day after emergence, chiefly because of the warmer weather. As a rule, a minimum temperature of 16°C. [60·8°F] is necessary for oviposition. About 16 per cent. of second-generation eggs collected in the summer of 1937 were parasitised by a species of *Trichogramma*. The duration of the egg stage varied from 5 days at an average temperature of 28°C. [82·4°F] to 16 at 15·5°C. [59·9°F.].

The newly hatched larvae wandered irregularly on the leaves and fruit for periods that ranged from 12 minutes to 5 days. They sometimes covered a total distance of several yards, occasionally stopping to emit fine threads of silk, which they fastened to protuberances, or to gnaw the lower surfaces of the leaves. They generally rejected the chewed particles, and although larvae 3–4 days old were occasionally observed to feed on the leaves, field experiments showed that they could not complete development on leaves alone. On reaching the fruits, they wandered on them in search of a suitable point of entry. In 1937–38, most first-generation larvae entered the apples at the calyx, but in 1939 only a third of them did so. Those that reached the calyx end gnawed the sepals, first rejecting the particles bitten off, but later ingesting them, and gradually penetrated into the fruit. The others, and most of those of the summer generation, entered at the side and also rejected the surface particles. Penetration was accelerated by high temperature, direct light, and a low relative humidity and consequent rapid evaporation. Observations showed that the larvae ingest lead arsenate on leaves and fruit with cell-sap from the particles that are chewed but then rejected, and probably also after contact of the mandibles with treated surfaces while emitting silk. Of 100 newly hatched larvae allowed to wander on apple branches bearing leaves and fruit sprayed with lead arsenate, 31 per cent. died, though there was no trace of feeding by them. Particles of poison were observed adhering to their mouth parts.

In a final note, the author discusses the efficacy of a calyx spray on apples. Since on 5 varieties of apple sprayed at petal fall with lead arsenate to which colouring matter was added, the poison reached the receptacle in only 15 per cent. of cases, he concludes that it is not highly effective. It is of some value, however, since poison is deposited on the sepals.

DeNardo (A.). **Report on Plant Pathology for 1937–38.**—*Rep. Dep. Agric. Malta 1937–38* pp. lvi–lviii. Malta, 1939.

Damage to potatoes in Malta by *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., was less in 1937–38 than in the previous year [*cf.* *R.A.E.*, A **26** 469]. A first attempt to introduce its parasite, *Microbracon gelechiae*, Ashm. (*Habrobracon johanniseni*, Vier.), from the United States was unsuccessful. *Phylloxera vitifoliae*, Fitch (*vastatrix*, Planch.) continued to destroy vines, but did not damage those on American rootstock. *Pseudococcus* (*Dactylopius*) *vitis*, Nied., increased considerably on vines, and sooty mould (*Capnodium salicinum*) was associated with it. Aphids were very prevalent on fruit trees at the beginning of spring, but were rapidly controlled by Coccinellids, of which the most important was *Coccinella septempunctata*, L. *Ceratitis capitata*, Wied., was not observed until early July, when most of the stone fruits were already harvested. It was therefore unable to multiply, and later caused little damage to *Citrus*. Other pests included *Cydia* (*Carpocapsa*) *pomonella*, L., on apple and pear, and the Noctuid, *Diloba coeruleocephala*, L., larvae of which completely defoliated almond trees and then injured the unripe fruits.

Barnes (H. F.). **Gall Midges (Cecidomyidae) associated with Coffee.**—*Rev. Zool. Bot. afr.* **32** fasc. 3–4 pp. 324–336, 8 refs. Brussels, 1939.

This paper includes descriptions of two new genera and five new species, based on adults of both sexes except in the single instance indicated, and notes on the Cecidomyiids already known to be associated with coffee.

Dasyneura coffeae, sp. n., and *Ghesquierinia megalamellae*, gen. et sp. n., were bred from the flowers of coffee in the Belgian Congo, and males of the latter were found among examples of *Schizobremia coffeae*, Barnes, received from Tanganyika Territory in 1935. *Hyperdiplosis coffeae*, Felt, which was bred from the fruit of *Coffea liberica* in St. Vincent, may possibly feed on fungi. The larvae of *Mycodiplosis hemileiae*, sp. n., were observed feeding on the spores of *Hemileia vastatrix* on the lower surfaces of the leaves of coffee in Tanganyika Territory and Madagascar. Notes on this species in

Tanganyika are quoted from manuscript by the late A. H. Ritchie. He considered that the larvae are of no value in the control of the fungus. They pupated, sometimes in groups, under a web on either surface of the leaf, and as many as 25–30 per leaf were found. Full-fed larvae and pupae were attacked by a fungus that caused them to dry up. Characters are given distinguishing the larvae from those of *Retithrips syriacus*, Mayet, and *Physothrips xanthocerus*, Hood. *M. hemileiae* is usually found in June, July and August, after the cessation of the heavy rains and when patches of *H. vastatrix* appear on the leaves, particularly if the atmosphere is warm and humid. *R. syriacus* generally appears later, before the November or short rains. It causes silvered patches on the upper surface of the leaves of coffee, and also occurs on *Anona*, rose and vines, but is parasitised and effectively controlled by a Eulophid of the genus *Thripoctenus*. *P. xanthocerus* is found in patches of *Hemileia* in late July, August and September, but feeds on the lower surface of the coffee leaves in mid-November or later, according to the dryness of the season. In years in which thrips are numerous, it may attack the upper surface of the leaf and the fruit, and sprays are often necessary against it [*cf.* *R.A.E.*, A **21** 106].

A male and a female of a species of *Lestodiplosis* were reared from larvae associated with, and probably predacious on, *M. hemileiae* in Madagascar. In Tanganyika, a female of *Lestodiplosis* sp. and adults of *M. hemileiae* were obtained from coffee foliage under observation for a leaf-miner. It is considered probable that *H. vastatrix* was present on the foliage and that the species of *Lestodiplosis* was the same as that found in Madagascar ; it may, however, have been a coprophilous species associated with the leaf-miner.

Arthrocnodax walkeriana, Felt, was bred in Ceylon in 1914 from *Pseudococcus* sp. on coffee and from another Coccid (? *Walkeriana* sp.). *Schizobremia coffeae*, which is predacious on *P. kenyae*, LePelley (*lilacinus*, auct.) on coffee in Uganda and Tanganyika Territory [**24** 110 ; **25** 49], has also been reared from *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., on coffee in the Belgian Congo. *Megommata seychelli*, gen. et sp. n., which is the type of its genus, was found feeding on *Pulvinaria* sp. on an unknown plant on Derris Island, in the Seychelles, and *M. psidii*, sp. n., is described from females bred from larvae predacious on *P. psidii*, Mask., on coffee in the Belgian Congo. Females of a Cecidomyiid of which the exact systematic position has not yet been determined were also associated with *P. psidii* in the Belgian Congo, and a Cecidomyiid of which the author has not seen specimens was recorded in 1901 from the same Coccid on coffee in Java.

JANNONE (G.). **Note etologiche sul** *Corvultur crassirostris* **Rüppel (Aves) quale predatore delle cavalette in A.O.I.** [Notes on the Habits of *C. crassirostris* (Aves) predacious on Locusts in Italian East Africa].—*Boll. Idrobiol.* 1940 no. 1 repr. 8 pp., 1 fig. Addis Abeba, 1940.

One of the birds that are of importance as predators on locusts in Abyssinia is *Corvultur crassirostris*, which was observed to destroy numbers of hoppers and adults of *Locusta migratoria migratorioides*, R. & F., in 1939. *Corvultur affinis* is stated to feed on *Gryllus bimaculatus*, DeG., which in 1938 damaged various cultivated plants in Shoa.

JANNONE (G.). **Relazioni fra corsi d'acqua e spostamenti delle larve e ninfe di cavalette in A.O.I.** [Relations between Watercourses and Migrations of the Larvae and Nymphs of Locusts in Italian East Africa].—*Boll. Idrobiol.* 1940 no. 1 repr. 9 pp., 3 figs. Addis Abeba, 1940.

Observations in Abyssinia have shown that migrating bands of hoppers of *Locusta migratoria migratorioides*, R. & F., and of *Schistocerca gregaria*, Forsk., are able to cross streams of considerable width by swimming.

Memoria de la Comisión Central de Investigaciones sobre la Langosta correspondiente al año 1936.—298 pp., 28 pls. (6 col.), text ill. Buenos Aires, Minist. Agric. Argent., 1939.

This is the fourth and last of the series of annual reports by the Central Commission of Locust Investigations in Argentina [*R.A.E.*, **23** 73 ; **25** 114 ; **26** 146], which since 1937 has been replaced by the Institute for Locust Investigations.

In Informe de la Comisión Investigadora del Oeste (pp. 17–106, 33 figs., 9 pls.), P. Köhler records observations on the influence of temperature, wind and rain on the behaviour of hoppers and adults of *Schistocerca paranensis*, Burm., which he considers to be the gregarious form of *S. cancellata*, Serv. The balance of numbers of the solitary and swarming locusts and the colour changes in hoppers [*cf.* **26** 146] are discussed from a theoretical standpoint.

In Informe de la Comisión Investigadora del Este (pp. 107–142, 5 figs.), J. B. Daguerre mainly recapitulates his earlier views on the existence in Argentina of two specifically distinct locusts, the swarming *S. paranensis* and the solitary and non-migrating *S. cancellata* [*cf.* **28** 60]. He puts forward a suggestion that the solitary and gregarious forms of African locusts are not phases, but independent species.

In Investigaciones sobre la Langosta, experimentos en cautividad (pp. 143–190, 15 pls.), C. Bruch reports the results of breeding experiments with both the solitary and swarming locusts (*S. cancellata* and *S. paranensis*). Crowding, or isolation, of hoppers induced changes parallel to those observed in phases of other locusts, but no complete transformation was obtained, and the results are considered inconclusive [*cf.* **28** 189].

In Informe acerca de los trabajos realizados en el insectario de José C. Paz en 1936 (pp. 191–242, 2 pls.), J. Liebermann gives an account of the equipment of the insectary and of miscellaneous experiments undertaken during the year. The parasites of *S. paranensis* observed were *Sarcophaga caridei*, Brèthes, the Phorid, *Puliciphora pectinata*, Blanch., and various mites.

In Ensayos de espolvoreos para destruir langostas en masa (pp. 243–252), P. Köhler describes field experiments in controlling locusts by a motor dusting apparatus. A standard dust of 50 per cent. chalk, 45 per cent. sodium arsenite and 5 per cent. disodium phosphate gave poor results, and a study of the dust deposits showed that most of the sodium arsenite fell to the ground within 28 yards of the apparatus, although the dust cloud reached beyond 160 yards [*cf.* **28** 65]. A mixture of chalk and sodium arsenite in approximately equal proportions, applied at the rate of 45 lb. sodium arsenite per acre, gave good mortality up to a distance of 77 yards from the apparatus. Low air humidity delayed the action of the poison. Similar results were obtained with pure sodium arsenite. It is concluded that dusts have a great future in locust control, particularly if they are applied from aeroplanes.

In Informe sobre los experimentos llevados a efecto con máquina espolvoreadora (pp. 253–258, 2 figs.), by J. B. Daguerre, further large-scale dusting experiments with the same insecticides are reported. The method was particularly effective in cool and damp weather when the locusts formed dense swarms and the poison acted more rapidly. The dust should be applied at the rate of 90 lb. per acre.

In Los Acridios de Mendoza, con observaciones acerca de su ecología y distribución (pp. 259–296, 3 pls.), J. Liebermann gives a list of the Acridids of the Province of Mendoza, with notes on their ecology. An important pest in the Uspallata valley, about 6,000 ft. above sea-level, is *Trigonophymus* (*Dichroplus*) *arrogans*, Stål, which is favoured by the cultivation of lucerne. *T.* (*D.*) *elongatus*, Giglio-Tos, which also causes great damage to lucerne, is generally distributed in the Province. Eggs of *Schistocerca paranensis* that were observed to hatch very late in the season may represent a second generation produced in a single year.

SQUIRE (F. A.). **A Note on the Resistance of *Hibiscus esculentus* and *Gossypium trilobum* to *Platyedra gossypiella* Saund.**—*Emp. Cott. Gr. Rev.* **16** no. 4 pp. 268–271, 3 refs. London, 1939.

In view of the fact that observations in the West Indies have shown that infestation of the capsules of *Hibiscus esculentus* by *Platyedra gossypiella*, Saund., reaches 80 per cent. in the neighbourhood of heavily infested cotton but falls to practically 0 as soon as the cotton is removed [*cf. R.A.E.*, A **28** 44], investigations were carried out in the laboratory on this apparent resistance.

Of newly hatched larvae of P. *gossypiella* placed on individual capsules of *H. esculentus* in lamp chimneys, many were found on the surface, drowned in slime, after 24 hours. It was found that in the process of entering the capsules, the larvae cut through the mucilage sacs that largely constitute the succulent wall, with the result that they were drowned, either in their burrows or on the surface. When 10 larvae were placed on each capsule, the percentage mortality due to mucilage and the total percentage mortality were 41·7 and 86·6, respectively, on capsules 6–7 days old, and 12·5 and 90 on those 10–12 days old. With 5 larvae on capsules 6–8 days old, the corresponding figures were 30 and 78. Capsules 10–12 days old are hard and fibrous, and the high total mortality on them is possibly due to aversion or to difficulty in penetration. It is considered possible that a multiple infestation may drain the capsule, and so facilitate subsequent penetration.

About half the larvae failed to penetrate when placed on bolls of *Gossypium trilobum* ; none became established, and the seeds showed no signs of attack. When attempts were made to breed newly hatched larvae on halved seeds, about 33 per cent. survived. It is evidently the seed and not the capsule wall of *G. trilobum* that is distasteful or resistant.

BEALL (G.). **Methods of estimating the Population of Insects in a Field.**—*Biometrika* **30** pt. 3–4 pp. 422–439, 3 figs., 1 fldg. table, 10 refs. London, 1939.

An account is given of an investigation, from a statistical point of view, of the consequences of applying certain sampling methods to the problem of finding the numbers of adults of *Leptinotarsa decemlineata*, Say, on a heavily infested potato field in Ontario. From observations of the population per 2 ft. row of potatoes for entire rows, sampling units were variously formed and their relative desirability studied.

It is shown that the necessary calculations are simplified when the strata, or subdivisions of the field, can be made equal. In the field considered, variability was much greater between than within strata. It was found that a marked reduction in the area that must be examined to secure a given degree of accuracy in the estimate of population could be secured, first by stratification, and secondly, by making the number of sampling-units examined in a given stratum proportional to the standard deviation for the sampling-units in that stratum. These standard deviations will not, in general, be known, and the experimental data are used to illustrate how their values may be replaced by estimates obtained from a preliminary survey.

Schechter (M. S.) & Haller (H. L.). **The Identity of Pyrethrosin with Chrysanthin and Non-identity with Geigerin.**—*J. Amer. chem. Soc.* **61** pp. 1607–1608, 5 refs. Easton, Pa., 1939.

From the evidence adduced, together with the fact that chrysanthin or pyrethrosin has been obtained by several investigators from only one species of plant, *Chrysanthemum cinerariaefolium*, it is concluded that these two compounds are identical. It is clear from the recorded data that chrysanthin and geigerin, which was isolated from *Geigeria aspera*, are not identical, and it therefore follows that geigerin and pyrethrosin are not the same. It is suggested that the name pyrethrosin be retained for this crystalline product obtained from *C. cinerariaefolium*, and that all others be discarded.

Hartzell (A.) & Wilcoxon (F.). **Experiments on Control of Japanese Beetle Larvae with β, β′-dichloroethyl Ether.**—*Contr. Boyce Thompson Inst.* **10** no. 4 pp. 509–513, 1 fig., 7 refs. Menasha, Wis., 1939.

The experiments described were carried out in New York State to test the toxicity of β, β′-dichloroethyl ether as a soil fumigant for the control of the larvae of *Popillia japonica*, Newm., in turf. It was applied in the form of a saturated solution (8·36 cc. per litre), with or without the addition of 0·1 or 0·5 per cent. of a sulphated alcohol (Tergitol 7 penetrant), at the rate of 1 U.S. gal. per sq. yard by means of a power sprayer. Small areas can be treated with a sprinkling can. Single applications at the end of summer, before all the eggs had hatched, gave poor control in two tests, but one application at the end of September of the solution containing 0·5 per cent. of the sulphated alcohol gave 68·4 and 62·0 per cent. mortality with slight injury to the turf. Two applications at an interval of 4 or 5 days at this time gave 96·4 and 80·4 per cent. mortality, but injury to the turf was severe. Two applications, a week apart, in early May, gave 86·9 per cent. mortality without injuring the turf when 0·1 per cent. of the sulphated alcohol was added, and 28·3 when it was omitted. The mortalities given by a mixture of powdered lead arsenate and garden soil (1 : 3) broadcast at the rate of 40 lb. per 1,000 sq. ft. of turf and raked in to a depth of $\frac{1}{4}$ inch were negligible within about a month, but averaged 72 per cent. by 1st May when the applications were made in autumn.

It is concluded that two applications of dichloroethyl ether followed two weeks later by one of lead arsenate would combine the advantages of quick action with that of residual effect. In situations where poisonous residues are undesirable, dichloroethyl ether may possibly offer an effective substitute for lead arsenate.

MURRAY (C. W.) & RYALL (A. L.). **Removal of Phenothiazine Spray Residues from Apples.**—*Indust. Engng Chem.* News Edn. **31** no. 24 p. 407, 1 ref. Easton, Pa., 1939.

The results of experiments on the removal of spray residues of thiodiphenylamine (phenothiazine) from apples are given in a table. They showed that a residue of 0·060 grain per lb. fruit is reduced to 0·01 by a single process of brushing and flooding in 1·5 per cent. hydrochloric acid at 110°F. A double flooding process, using 60 lb. sodium silicate per 100 U.S. gals at 110°F. followed by 1·5 per cent. hydrochloric acid and 1·0 per cent. mineral oil at 100°F., reduced it to 0·002 or less. Without the mineral oil it was reduced to not more than 0·006. The fruit was exposed to each washing solution for 30 seconds.

WORTHLEY (H. N.) & STEINER (H. M.). **Apple Insect Control Studies in 1938.**—*Bull. Pa agric. Exp. Sta.* no. 376, 13 pp., 2 figs. State College, Pa, 1939.

An account is given of experiments on the control of the codling moth [*Cydia pomonella*, L.] on apple in an orchard in Pennsylvania in 1938. Damage by first-generation larvae in June and early July was slight, and most of the injury was caused in late July and August by larvae from adults that flew in from an adjacent untreated orchard. Lead arsenate was used at the rate of 3 lb. per 100 U.S. gals. in all sprays except where otherwise stated, and lime-sulphur was included in most of them. All sprays gave considerable reduction in infestation. Four cover sprays on 25th May and 6th, 17th and 30th June, timed by means of trap catches, gave better results than three on 25th and 31st May and 9th June, timed by fruit growth, and soy-bean flour was a better adhesive than skim milk powder. Still better control was given by 2 sprays applied on 25th May and 6th June, of which the first contained 3 lb. lead arsenate and a mixture of 4 lb. copper phosphate, 8 lb. hydrated lime and 4 lb. bentonite per 100 U.S. gals. spray, and the second, in which the amount of lead arsenate and the amount of liquid applied per tree were both doubled, was an inverted spray. To prepare 100 gals. of the latter, 0·5 pint of a mixture of monoethanolamine and water (1 : 7) was added to 1 gal. water and 0·5 gal. of a mixture of 19 parts kerosene and fish oil (3 : 1) and 1 part oleic acid was stirred in until a milky emulsion resulted. This emulsion was added to the spray suspension of lead arsenate when the tank was nearly full. The lead arsenate flocculated within a few seconds, and spraying was then begun. Owing partly to the abbreviated schedule and partly to the substitution of copper phosphate for lime-sulphur, the amount of spray injury to foliage and fruit and the proportion of dropped fruit were much reduced. Very nearly the same degree of control was obtained by the substitution of fixed nicotine for lead arsenate in the third and fourth cover sprays supplemented by the application of two August sprays of fixed nicotine and oil against the second generation, but the cost in time and materials was considerable and the reduction in lead residue was slight.

In another experiment, designed primarily to study spray injury to the trees, the use of the mixture containing copper phosphate instead of lime-sulphur (1·3 per cent.) considerably reduced the effectiveness against *C. pomonella* of cover sprays of lead arsenate (3 lb. per 100 U.S. gals.).

The pistol case bearer [*Coleophora malivorella*, Riley] is present on apple in most orchards in south-eastern Pennsylvania, but causes little damage, except over about 500 acres in Adams County. The area in which it is most abundant appears to have been shifting to the north and east in recent years. In 1938, overwintered larvae fed from 22nd March until 13th June and the older larvae caused superficial damage to the fruit. Varieties of apple with late bud development were the most severely injured, as they provided little early foliage, and many buds were destroyed before they were fully open. About 90 per cent. of the larvae pupated in their cases between 1st and 15th June. Many of the healthy ones dropped to the ground, and most of those left on the trees were dead or parasitised. The adults began to emerge on 18th June and 97 per cent. had emerged by 1st July. Oviposition continued from 21st June to mid-July ; the eggs were laid on the upper surface of the leaves and 77 per cent. were in the upper part of the tree. The larvae hatched between 2nd and 25th July and fed on the leaves until 18th October. Preliminary experiments on control indicated that though an increase in population may be prevented by the use of lead arsenate in a full schedule of foliage sprays, an outbreak can be reduced only by special sprays applied against the eggs and young larvae in early July. Two applications, on 1st and 16th July, of 0·75 per cent. Orthol K summer oil containing nicotine sulphate (1 : 800) gave 97 per cent. control, and two of 1 per cent. oil alone and one of the mixture of both gave 84 per cent.

An account is also given of experiments already noticed [*R.A.E.*, A **27** 535] on the control of the rosy apple Aphid [*Anuraphis roseus*, Baker] and the European red mite [*Paratetranychus pilosus*, C. & F.] in 1938.

Isely (D.). **Timing seasonal Occurrence and Abundance of the Codling Moth.**—*Bull. Ark. agric. Exp. Sta.* no. 382, 26 pp., 6 figs., 6 refs. Fayetteville, Ark., 1939.

This paper deals with studies in Arkansas in 1936–38 on the effect of temperature on the oviposition of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple, the main results of which have already been noticed [*R.A.E.*, A **26** 731], and, more briefly, with observations of the dates on which various percentages of the larvae enter hibernation instead of pupating. During early summer, practically all full-grown larvae pupated, but as the season advanced, an increasing proportion entered hibernation, and in August the majority did so. A small number of the larvae that became full-grown in September gave rise to adults that oviposited in the same year. The ripeness of the fruit did not appear to be a factor determining whether the larvae should pupate or hibernate. The time when a large majority of larvae began to enter hibernation appeared to be later in relatively cool seasons than during hot ones.

The average date of emergence of adults in the succeeding spring was 3–4 days earlier in the case of larvae that entered hibernation before 1st September than from those that did so after that date.

JONES (D. W.), WALKER (H. G.) & ANDERSON (L. D.). **The European Corn Borer on the Eastern Shore of Virginia.**—*Bull. Va Truck Exp. Sta.* no. 102 pp. 1621–1648, 4 figs., 5 refs. Norfolk, Va., 1939.

The following is based on the authors' summary: On the Eastern Shore of Virginia, which comprises the two counties of Accomac and Northampton, the population of *Pyrausta nubilalis*, Hb., has varied greatly from year to year since its discovery there in 1931. It has also been found in small numbers in ten other counties of Virginia, bordering on the Chesapeake Bay or the Potomac River. Its abundance on the Eastern Shore decreased sharply in May 1936, reached a maximum in September 1937, and again decreased significantly in 1938, so that the population in January 1939 was about the same as in February 1936. There are three generations annually on the Eastern Shore; the first infests principally the stems of potatoes and the second and third develop mainly in maize. In general, the first generation extends from the first part of May to the middle or latter part of June, the second from late June to early August, and the third from mid-August to April or May. Feeding injures potatoes and probably causes a reduction in yield, the amount of damage caused by a given population probably varying from year to year according to general growing conditions.

Variations in weather conditions at different stages of the growing season influenced the abundance of borers so much that it was impossible to establish definitely by experimental plantings the influence of date of planting on the relationship between abundance of borers and yield of maize. From an agronomic standpoint, however, maize planted between 15th May and 19th June gave higher yields over a period of four years than maize planted earlier or later. From studies of different varieties of maize, it appears that certain new hybrid strains of maize will produce higher yields than the local varieties generally grown. Soil variations, heavy rains and water injury to the plants have made further study necessary before definite conclusions can be drawn as to the best varieties to plant on the Eastern Shore.

The principal factors affecting the abundance of *P. nubilalis* are weather, farm practices, and predators and parasites. The winter and early spring mortality of larvae due to weather is negligible. Drought and hot drying winds caused heavy mortality among eggs and small larvae. Favourable weather for all three generations in 1937 resulted in a remarkably rapid increase in numbers. Some borers are removed from a maize field if the stalks are topped, but most are eliminated if the stalks are cut low and used as food for livestock in pens, provided that those at the edges of the pens are turned towards the centre at least once to insure their being trampled in the wet manure. This should be done before 20th April. Hand clearing of débris left on the fields helps to reduce infestation. Disking and ploughing either high stubble or topped stalks leaves too many larvae in the field to be effective as a control measure. Weeds are of little importance as food-plants at present. Early digging of potatoes will destroy many of the first-generation larvae and pupae before they are able to complete their development in the stalks. Predators and parasites are of some value late in the season. Six species of imported parasites have been liberated on the Eastern Shore. Of these, *Lydella stabulans* var. *grisescens*, R.-D. [the Tachinid commonly known as *Ceromasia senilis*, Mg.] has become established and is maintaining itself, and *Cremastus flavoorbitalis*, Cam., and *Chelonus annulipes*, Wesm., have been recovered in small numbers. The only native parasite is *Trichogramma minutum*, Riley. In 1937, 0·60 per cent. of the second-generation eggs and 4·95 per cent. of the third-generation eggs examined were parasitised by it.

[Insect Pests in New Mexico in 1937–38.]—*Rep. New Mexico agric. Exp. Sta.* **49** (1937–38) pp. 43–57, 7 figs. State College, N.M. [1939.]

The effect on the yield of potatoes of dusts of sulphur and bentonite sulphur, both with 4 per cent. nicotine dust, and of sprays of 2½ U.S. gals. liquid lime-sulphur or 5 lb. dry lime-sulphur, both with 2 lb. Kolofog [bentonite sulphur], in 100 U.S. gals. water, applied [against *Paratrioza cockerelli*, Šulc] for the control of Psyllid yellows, was tested in New Mexico in 1937 and 1938. The dusts were used at the rate of 20 lb. per acre. The yields per acre from certified seed from Colorado varied from 15,053 to 18,872 lb., after the various treatments, with no significant difference between the yields after the use of the dusts and the liquid lime-sulphur spray, which were superior to the spray of dry lime-sulphur, and those from seed from the same strain, but grown for one year in New Mexico, varied from 9,779 to 12,954 lb., with no significant difference between the four treatments. The control plots gave 9,708 and 6,851 lb. per acre, respectively.

During further investigations on the relation of bacteria to the fermentation of baits and their attractiveness to the codling moth [*Cydia pomonella*, L.] it was found that three species of heterofermentative bacteria, the characteristics of which are briefly described, were largely responsible for the attractiveness of fermenting molasses baits under New Mexico conditions [*cf. R.A.E.*, A **26** 137]. All the filters used to prevent the contamination of the bait were found to be unpractical on account of the great reduction in the number of moths caught. Only a few of the organic alcohols, acids, and esters closely related to those found in carbohydrate media fermented by these bacteria were found to be more attractive than fermenting cane syrup. Two seasons' work showed that simple compounds, such as acetic acid, ethyl and methyl alcohols and ethyl acetate were less attractive than the more complicated phenyl derivatives and their esters.

Field tests were made to compare the catches obtained with syrup suspensions of these bacteria and those obtained with syrup alone. The jars were surrounded with electrified grids, which considerably increased the catches. The numbers of moths caught during a period of 34 days averaged 6·7 per jar per day for the suspension of *Aerobacter aerogenes*, 2·1–2·9 for those of the other two bacteria, and only 1·8 for syrup alone. The consistently larger catches obtained when the electrified grids were used are considered to indicate that many moths, although attracted to baits in ordinary glass jars, usually escape.

The attractiveness of plain glass jars was not increased by painting them with certain phosphorescent or luminous paints or with aluminium paint.

TURNER (N.) & TOWNSEND (J. F.). **Control of Termites in Buildings.**—*Circ. Conn. agric. Exp. Sta.* no. 134, 14 pp., 8 figs. New Haven, Conn., 1939.

A briefer account than one already noticed [*R.A.E.*, A **24** 387] is given of the bionomics of *Reticulitermes flavipes*, Kollar, in Connecticut and methods of preventing damage to buildings by it. The soil treatments mentioned, which have not been entirely successful, include the application of 1 lb. sodium arsenite in 12–25 U.S. gals. water per 8–10 linear feet of trench 1–3 ft. deep, dug round the foundations of the building, or of 1 U.S. gal. of a mixture of equal quantities of creosote and kerosene per 5 linear feet of trench. The latter acts as a repellent. Brief notes are given on other insects that damage wood or are frequently confused with termites in Connecticut; they include the weevil, *Rhyncolus* (*Hexarthrum*) *ulkei*, Horn [*cf.* **16** 636], which has been found in several buildings.

DAMERON (W. H.) & SMITH (H. P.). **Prickly Pear Eradication and Control.**—*Bull. Texas agric. Exp. Sta.* no. 575, 55 pp., 29 figs., 6 refs. College Station, Tex., 1939.

This bulletin contains an account of recent work on the eradication of prickly-pears (*Opuntia* spp.) in Texas, where they are widespread and are injurious to livestock that acquire the habit of feeding on them. A brief section (pp. 21–23) deals with the insects observed attacking prickly pear in this State. They are unlikely to eradicate it as their numbers are kept down by parasites, but it is hoped that they will give partial control in districts in which prickly-pear has become dense. The most numerous and effective are moth-borers of the genus *Melitara*. Others are the Coccid, *Dactylopius confusus*, Ckll., which sucks the juice from the plants until the infested parts die, Lamiids of the genus *Moneilema*, the larvae of which infest the stems and roots, and the Coreid, *Chelinidea vittiger*, Uhl. The mite, *Tetranychus opuntiae*, Banks, which causes the plant to form a corky tissue that ultimately kills it, is destroyed by heavy rain and is usually effective only in dry winters. The fungus, *Gleosporium lunatum*, which is responsible for extensive destruction of young growth in damp springs, often enters the plant through holes from which *Asphondylia opuntiae*, Felt, has emerged, and is also carried from plant to plant by *Chelinidea*.

List of Intercepted Plant Pests, 1938.—*S.R.A., B.E.P.Q.* [1938] 62 pp. Washington, D.C., U.S. Dep. Agric., 1939.

In the method of selecting and presenting data, this list of pests intercepted between 1st July 1937 and 30th June 1938 with plants or plant products entering United States territory is similar to the preceding one [*R.A.E.*, A **27** 462], but the total number of records has been markedly reduced by eliminating many items formerly recorded, particularly at the port of New York. The section on interceptions in aircraft is omitted. A list of fungi attacking some of the insects intercepted is included.

Service and Regulatory Announcements, July-September, 1939.—*S.R.A., B.E.P.Q.* no. 140 pp. 97–129. Washington, D.C., U.S. Dep. Agric., 1939.

Information in this part includes summaries of plant quarantine restrictions in Sierra Leone, Bermuda and Paraguay and also amendments to summaries already noticed of restrictions in Italy, Turkey, Kenya Colony, Australia, Mexico, Cuba, Jamaica, Argentina and Colombia.

Houser (J. S.). **The Wheat Field Survey for 1939.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **24** no. 200 pp. 135–141, 5 figs. Wooster, Ohio, 1939.

The average infestation of wheat by *Mayetiola* (*Phytophaga*) *destructor*, Say, increased to 20·5 per cent. in Ohio in 1939 [*cf. R.A.E.*, A **27** 83] and was highest in the north-central part of the State. It is considered that this increase was due to neglect of the correct sowing dates and that the crop of 1940 will be seriously damaged unless these dates are carefully observed. Infestation by *Trachelus tabidus*, F., continued to decline in areas already infested, and spread little [*cf. loc. cit.*]. Significant numbers of *Harmolita tritici*, Fitch, were observed in the central part of the State in 1939. This Eurytomid overwinters in the larval or pupal stage in the walls of stubble or fallen straw. The adults emerge at about the time at which the wheat heads appear in spring, and oviposit in the joints of the straw. The larvae attack the straw walls, and cause galls, several of which may combine to form a compact mass. At the point of injury, the straw is weakened and may bend while the galls are being formed, but becomes very stiff later, and these sections of straw are difficult to separate from the grain when the wheat is threshed.

Siegler (E. H.), Munger (F.) & Smith (L. E.). **Toxicity of certain organic Insecticides to Codling Moth Larvae in Laboratory Tests.**—*Circ. U.S. Dep. Agric.* no. 523, 9 pp., 2 refs. Washington, D.C., 1939.

Details are given in tables of the results of tests carried out in 1934–36 by the apple-plug method of the toxicity of large numbers of organic compounds to larvae of *Cydia* (*Carpocapsa*) *pomonella*, L. The main conclusions have already been noticed [*R.A.E.*, A **25** 188; **26** 575].

Beal (J. A.). **The Black Hills Beetle, a serious Enemy of Rocky Mountain Pines.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1824, 21 pp., 18 figs. Washington, D.C., 1939.

An account is given of the bionomics, importance and distribution in the United States of *Dendroctonus ponderosae*, Hopk., and the methods that have been employed, in recent cases often with success, to prevent and suppress outbreaks. Much of the information is similar to that already noticed [*R.A.E.*, A **14** 243; **15** 428; **20** 609, etc.]. The first major outbreak on which observations were made occurred in South Dakota from 1895 until 1908, and resulted in the killing of between one and two thousand million board feet of timber of ponderosa pine [*Pinus ponderosa*]. More than 300 million board feet of timber was killed in Arizona between 1917 and 1925. More recent outbreaks caused the death of 100,000 trees in northern Colorado in 1923–30 and of 20,000 in south-western Colorado in 1933–36, and one that has been in progress since 1932 in stands of timber and lodgepole pines [*P. flexilis* and *P. contorta* var. *latifolia*] in south-eastern Wyoming has involved an average loss of 60,000 trees annually. *P. ponderosa* is the preferred tree, but many other pines, of which the most important are whitebark pine [*P. albicaulis*] and limber and lodgepole pines, are also attacked.

This Scolytid usually completes one generation in each year, but at heights of 9,000–10,000 ft. in the northern limits of its range a small proportion of the population requires two years for complete development. It breeds in weakened or injured trees 6 ins. or more in diameter when it is not abundant, but when it becomes numerous it attacks smaller trees and those of vigorous growth. The adults carry certain blue-staining fungi into their mines, and as a result of the development of these fungi in the sapwood and of the numerous galleries of the adults and larvae in the cambium region, the movement of water from the roots to the leaves is prevented, and the tree is girdled and killed. Notes are given on the means of distinguishing *D. ponderosae* from four species of the same genus that are likely to be mistaken for it and from three species of *Ips* normally found associated with it. Small masses of pitch that occur on the bark at the entrance holes, and boring dust present in bark crevices and at the foot of the trees are the only indications of infestation until the year after the attack, when the foliage begins to fade in late spring or early summer, and later turns reddish brown. During the second year after infestation the needles begin to fall. Pine forests in the Rocky Mountains region should be inspected periodically, and the number of trees with discoloured foliage should be compared with the number newly infested to determine the trend of the infestation. Control work should be begun on trees such as *P. contorta* var. *latifolia* if groups of 3–5 infested trees are found and the number infested averages 64 per section [square mile], and on *P. ponderosa* if they average 20 per section. Trees with red foliage or with only a few large pitch masses and no completed egg galleries under the bark should not be treated. The infested trees should be felled and barked or burnt sufficiently to char the entire bark, while the insects are in the immature stages, or, if they can be logged and taken to a saw-mill, they should be sawn into lumber and the slabs containing the insects burnt.

SNIPES (B. T.). **Experiências sobre o combate de** *Heliothis obsoleta* **Fabr., praga do milho (Lep. Noctuidae).** [Experiments in the Control of *H. armigera*, Hb., Pest of Maize.]—*Rev. Ent.* **10** pt. 2 pp. 289–309, 3 graphs, 9 refs. Rio de Janeiro, 1939.

A brief survey is given of the bionomics of *Heliothis armigera*, Hb. (*obsoleta*, F.), the injury it causes to maize and other plants, the measures recommended against it in various parts of the world, and the factors, including climate and natural enemies, that contribute to a reduction of its population. In experiments on its control made in the State of Minas Geraes, Brazil, in 1938, a field of young maize was divided into 4 plots with a uniform number of infested plants and little difference in the distribution of the larvae. The plot with the fewest larvae per plant served as a control, and the three others were treated. In the first of these, a small quantity of a poison bait consisting of 25 lb. wheat bran, 25 lb. sawdust, 3 lb. white arsenic (As_2O_3), 1 gal. molasses, and 2½–3 gals. water was placed in the crown of each plant. The second plot was dusted with a mixture of equal parts of Paris green and wheat flour. In the third, the poison bait was broadcast at the rate of about 18 lb. per acre. The plots were examined at intervals of 2 days, and the results are shown in tables and graphs and analysed statistically.

There was a normal rise in numbers in the control plot, and there was no significant reduction in infestation in the plot in which poison bait was scattered. By the sixth day, the percentage larval mortality was 70 in the plot in which bait was placed in the crowns, and 64 in the dusted plot. The difference between these percentages was not statistically significant. In both areas the toxic action persisted for 10 days or a little less, but the maximum efficiency was reached in 6 days. It is suggested that where cost is of secondary importance, either of these two methods should be used for young maize. Dusting was more rapid in action, but it was more expensive and scorched the terminal shoots and tender leaves in strong sunshine.

FENNAH (R. G.). **A Summary of experimental Work on Varietal Resistance of Sugar-cane to *Tomaspis saccharina* 1936–39.**—*Trop. Agriculture* **16** no. 10 pp. 233–240, 1 pl., 4 refs. Trinidad, 1939.

The following is based on the author's summary : In field experiments in Trinidad it was shown that Co.213 and Uba were less attacked by *Tomaspis saccharina*, Dist., than other varieties of sugar-cane, including B.H.10(12), a normally susceptible variety under plantation conditions. No differences in leaf structure were found that would support the theory of mechanical protection of Co.213 against attack. In tests in olfactometers, the difference in selection by *T. saccharina* was found to be the same as noted in the field ; it was also found that the odour of a leaf of B.H.10(12) was preferred to that of grass (Guatemala grass) and of a non-commercial cane, *Saccharum ciliare*. The apparent explanation of the resistance of Co.213 and Uba is that *T. saccharina*, when able to obtain a choice, largely attacks the canes with the most attractive odour, though it is quite well able to feed on any variety at need. This would fit in with the observations that all the canes now commercially grown in Trinidad may suffer from attack, and that on the whole, noble canes suffer more than those with a large admixture of wild strains.

Concerning the nature of the attractant, it was noted that odours from a leaf extract were no more attractive than odours from a leaf ; that leaf extracts practically devoid of sugar were as attractive as a two per cent. solution of sucrose ; and that leaf extract with three per cent. sucrose (2 : 1) was definitely preferred to leaf extract alone. Both the sucrose and the leaf extracts were preferred to water alone. These results show that there are two attractants in the plant, both of which will occur in varying quantity in the leaf. To the author, the odour of the fresh leaf extract was strongly reminiscent of that of newly-cut grass ; the sucrose solution from Trinidad No. 1 sugar had a faint aroma of molasses ; that from refined sugar was odourless. It is of importance that sucrose, which is needed in high concentration in commercial cane, is itself an attractant to *T. saccharina*. It seems unlikely that the grassy odour of sugar-cane will be reduced by selection or breeding, though it is possidle that it has its own grades of attractiveness; it is certainly undesirable that canes of low sucrose content should be grown. Moreover, absolute lack of attractiveness arising from failure on the part of the sugar-cane to stimulate froghoppers through their olfactory receptors is not known at present, and is not likely to be attained. Such lack of attraction is far more likely to result from the neighbourhood of another variety comparatively more desirable. There is some danger that the good performance of a variety in randomised plot experiments on varietal resistance may result rather from the fact that it is surrounded by more attractive varieties than from any absolute relationship between its physiological characteristics and the responses of *Tomaspis*. It is possible that such a variety in a large stand would fare no better as regards infestation than any of the comparatively resistant types now in use, if no more attractive types were available in the area.

SQUIRE (F. A.). **Observations on Cotton Stainers** (*Dysdercus*) **in the West Indies.**—*Bull. ent. Res.* **30** pt. 3 pp. 289–292, 3 figs., 9 refs. London, 1939.

On the basis of observations in the Lesser Antilles and information in the literature, records are given of the distribution in the West Indies, British Guiana and British Honduras of the 10 species of *Dysdercus* that occur there and of the principal food-plants of members of this genus in the West Indies. In general, wetter islands, such as Grenada and St. Vincent, have a greater variety of food-plants than drier ones, such as Montserrat, where the eradication of one species of plant proved a successful control measure. In St. Vincent, where the only species of *Dysdercus* is *D. discolor*, Wlk. (*delauneyi*, Leth.), the destruction of two species of plants has suppressed the insect in the greater part of the island, but it is still a serious pest in the Carib country, where there still exists a complete cycle of food-plants. This cycle is shown in a figure.

EVANS (J. W.). **A new Species of** *Dieuches*, **Dohrn (Hem. Lygaeidae) injurious to Strawberries in Tasmania.**—*Bull. ent. Res.* **30** pt. 3 pp. 305–306, 1 fig., 2 refs. London, 1939.

The Lygaeid here described as *Dieuches raphaeli*, sp. n., has been known for a considerable time as a pest of strawberry in Tasmania under the name of the strawberry bug. It has been stated to occur in Victoria and New South Wales also, but it is possible that the statement refers to an allied species. The bugs may be found in abundance under plants in rockeries and in other situations where there is an accumulation of dead dried vegetation. They feed on ripe and ripening strawberries, causing distortion and discoloration and imparting a disagreeable taint.

PERKINS (J. F.). **The** *Ephialtes* (**Hym. Ichn.**) **parasitising the Codling Moth.**—*Bull. ent. Res.* **30** pt. 3 pp. 307–308, 4 figs. London, 1939.

Ichneumonids of the genus *Ephialtes* bred from *Cydia pomonella*, L., have usually been determined as *E. extensor*, Tschb. The author states, however, that the species bred from this host are *E. caudata*, Ratz., and *E. crassiseta*, Thomson, and that *E. extensor* is a synonym of *E.* (*Pimpla*) *punctulata*, Ratz. Keys to both sexes of the three species are given.

DUMBLETON (L. J.). **Contribution to the Physical Ecology of** *Tortrix postvittana*, **Walk. (Lep.).**—*Bull. ent. Res.* **30** pt. 3 pp. 309–319, 2 figs. London 1939.

The following is the author's summary: The thermal constant and the zero of the velocity curve have been determined for each of the pre-adult stages of *Tortrix postvittana*, Wlk. The experimental methods are described. The thermal constant for the eggs is 153 day degrees C. [275·4 F.] and the zero of the velocity curve 4·80°C. [40·64°F.]. The corresponding constants for the larvae are 469 day degrees C. [844·2 F.] and 8·05°C. [46·49°F.], and for the pupae 182 day degrees C. [327·6 F.] and 5·93°C. [42·67°F.]. The experimentally determined constants and the mean monthly temperatures have been used to calculate the peak of the flight period of the adult moths at Huonville, Tasmania, during the 1935, 1936 and 1937 seasons. In three cases out of four the calculated dates approximate very closely to the observed dates for the peak of the flight period. The results of observations on the number, duration and head widths of the larval instars are given. The majority of larvae fed on young apple leaves had four instars. A greater proportion of the larvae fed on mature apple leaves had more than four instars. The length of larval life at 25°C. [77°F.] is significantly longer for both male and female larvae when they are fed on mature leaves. The head width of the final instar of four-instar female larvae is significantly greater than that of the final instar of four-instar male larvae. Food quality has no apparent influence on the head width of the final instar of either male or female larvae. At 25°C. the length of larval life of female larvae is significantly longer than that of male larvae when both are fed on the same food; the same tendency is exhibited at other temperatures. The separate velocity curves for male and female larvae are not significantly different in slope. The difference between velocity values for male and female larvae at the mean temperature approaches significance. Larval mortality increases rapidly at temperatures above 30°C. [86°F.], and 100 per cent. mortality occurs at 35°C. [95°F.]. Starved larvae at low temperatures and high humidities show a tendency for the survival time to increase with the size of the larvae. Final instar larvae under these conditions can survive for two and a half months.

PARSONS (F. S.). **Investigations on the Cotton Bollworm,** *Heliothis armigera*, **Hubn.** (*obsoleta*, **Fabr.**). **Part I.—The Annual March of Bollworm Incidence and related Factors.**—*Bull. ent. Res.* **30** pt. 3 pp. 321–338, 1 pl., 5 figs., 9 refs. London, 1939.

The following is substantially the author's summary: Methods for the quantitative survey of the incidence of *Heliothis armigera*, Hb., have been in continuous operation in the Barberton area of the eastern Transvaal from 1929 to the present; since 1933, the survey has been operated similarly in Swaziland and northern Natal. It was accepted early that the bollworm situation in cotton depends largely upon the influences exerted by other food-crops of the insect grown prior to and in association with cotton [*cf. R.A.E.*, A **26** 364 ; **27** 487, etc.], and investigations were instituted on the incidence, habits and reactions of *H. armigera* with respect to the chain of cultivated and natural food-plant situations existing under differing climatic conditions in the course of the year. This paper deals with the annual course of its incidence as indicated, in the first instance, by egg counts taken twice weekly, year by year, in examples of all food-plant situations according to methods of sampling and calculation devised here. Data are given for five years' observation in concrete examples of situations in the neighbourhood of the Cotton Experiment Station, Barberton. They are applicable to the much wider areas under record. Information derived from successive calculations of the number of eggs per crop area is used for discussion and graphic depiction of the annual course of bollworm activity, and evidence is supplied of periodical incidence of a markedly recurring nature. The year is divided into five periods of varying activity, which are related to the habits of the insect, particularly diapause phenomena, climate and food. Circumstantial evidence is provided that immigrant moths are not a contributing factor.

The close association of oviposition with the period of flower production on the food-plants is emphasised. This association in conjunction with the constancy in the interval between planting and the appearance of the first flowers of cotton and maize, the predominant rain-grown crops, permits a forecast of when egg-laying on these crops may be expected to begin in quantity. Data given for five years with widely differing planting dates evince the accuracy of forecasts so based. The heaviest bollworm attack of the cotton-growing season always fell within 4–6 weeks of the beginning of flowering in maize and cotton. It is particularly important to minimise losses amongst the cotton fruit set within this period, as it contributes a high proportion of the yield, and measures for preventing or reducing infestation of cotton have been focussed accordingly. A preference of ovipositing females for maize has long been used to divert moths from cotton at critical times, and the success of the measures is indicated in a figure showing for five years the relative oviposition on crops of cotton and maize of variable acreage. Evidence obtained from studies of moth emergence serves to explain the yearly recurrence of the periodical oviposition witnessed. There is a remarkable similarity in the times of year at which moths from successive sources cease activity. The information supplies a clear indication of the origin of moths that occasion the initial infestation of cotton and other summer crops and aids substantially in anticipating the arrival and duration of the first summer attack according to planting dates.

BENSON (R. B.). **On the Genera of the Diprionidae (Hymenoptera Symphyta).**—*Bull. ent. Res.* **30** pt. 3 pp. 339–342, 1 fig., 5 refs. London, 1939.

The author divides the Diprionine sawflies into 10 genera and gives a key to them. They comprise the following : *Nesodiprion* (type *Lophyrus japonicus*, Marlatt), *Diprion* (type *Tenthredo pini*, L., and also including only *similis*, Htg., and *nipponicus*, Rohw.), *Macrodiprion* (type *L.* (*M.*) *nemoralis*, Enslin), *Gilpinia* gen. n. (type *L. polytomus*, Htg., and including *fennica*, Forsius, *pallida*, Klug, *virens*, Klug, *abieticola*, Dalla Torre, *frutetorum*, F., *laricis*, Jur., and *socia*, Klug), *Prionomeion*, gen. n. (type *L. gaullei*, Konow), *Monoctenus* (type *T. juniperi*, L.), *Augomonoctenus* (type *A. libocedri*, Rohw.), *Zadiprion* (type *D. grandis*, Rohw.), *Neodiprion* (type *L. lecontei*, Fitch, and including *sertifer*, Geoffr., and many Nearctic species) and *Microdiprion* (type *L. pallipes*, Fallén).

Miller (N. C. E.). **A new Malayan Species of *Helopeltis* (Rhynchota, Capsidae).**—*Bull. ent. Res.* **30** pt. 3 pp. 343–344, 1 fig. London, 1939.

Helopeltis theobromae, sp. n., is described from the Federated Malay States, where it has been taken on cacao (*Theobroma cacao*) and on plants of annatto (*Bixa orellana*) growing about 200 yards from the cacao. No records have been received of damage to tea by this Capsid, but young tea shoots were readily accepted in the laboratory.

Marshall (Sir G. A. K.). **New injurious Curculionidae from Southern Africa.**—*Bull. ent. Res.* **30** pt. 3 pp. 359–363, 1 pl. London, 1939.

The new weevils described are : *Sciobius mordax* and *Glyptosomus angulatus*, feeding on the leaves of litchee, and *Lalagetes edax* and *Tanyremnus fallax*, damaging young pines, all in South Africa ; and *Tanymecus rapax*, damaging maize seedlings in Southern Rhodesia.

Some Common Insect Pests of Fruit Trees and Vines in South Australia.—*J. Dep. Agric. S. Aust.* **42** no. 12 pp. 1025–1036, 32 figs. Adelaide, 1939.

This paper comprises notes on the damage done by some of the commoner insects that attack fruit trees and vines in South Australia, and on their life-histories and control. Sprays of lead arsenate (3–4 lb. per 100 gals.) are recommended against most of those that feed on the leaves of deciduous fruit trees.

The adults of *Otiorrhynchus cribricollis*, Gylh., feed during the night on the edges of leaves of practically all fruit trees and many garden plants, particularly *Citrus*, apple, stone fruits and smooth-leaved evergreen shrubs. The larvae occur on the roots of weeds. The weevils hide in loose soil at the foot of the tree during the day, and are best controlled with a bait of 9 lb. minced or ground dried apple and 1 lb. sodium fluoride sprinkled in a narrow complete ring as close to the tree as possible, but not touching the bark. The eggs of the sawfly, *Caliroa limacina*, Retz., are laid in the bark of twigs of hawthorn [*Crataegus*] and various fruit trees, particularly cherry, pear and plum, and the larvae skeletonise the leaves. Adults of the Melolonthid, *Diphucephala colaspidoides*, Gylh., occasionally fly in large numbers to fruit trees near the uncleared scrub in which they normally live, rapidly defoliate them, and may damage the bark of the current season's growth. Infested trees should be sprayed with lead arsenate, and if swarming occurs repeatedly, scrub in the vicinity should be cleared. Various cutworms attack vines, some market garden crops and occasionally fruit trees ; they are best controlled by a bait of 30 lb. bran, 8 oz. Paris green and 4 lb. molasses, mixed with enough water to make it hold together. A small lump should be placed at the foot of each vine in the late afternoon or evening. The Arctiid, *Roeselia lugens*, Wlk., is particularly common in the southern non-irrigated districts. The larvae skeletonise the leaves of many species of *Eucalyptus*, and sometimes of neighbouring fruit trees. The Lymantriid, *Orgyia* (*Teia*) *anartoides*, Wlk., is indigenous on native wattles [*Acacia*], but will attack practically all fruit trees and many ornamental shrubs. The larvae feed on the leaf tissue, sometimes in great numbers. *Cydia pomonella*, L., which attacks all pome fruits, and occasionally some of the stone fruits and walnut, has two generations a year in all but the coolest apple districts in South Australia. The usual sprays and supplementary measures are recommended against it. The larvae of *Tortrix postvittana*, Wlk., infest the leaves of all kinds of fruit trees and many ornamental plants. They sometimes cause superficial injury to fruits and are often found feeding on the green rind of *Citrus* or in bunches of currants, which they web together.

The roots of apple, as well as of native species of *Acacia*, are attacked by the larvae of *Baryopadus* (*Leptops*) *robustus*, Ol., and *B.* (*L.*) *rhizophagus*, Lea, in various parts of South Australia. *B. robustus* usually infests weakened trees, but *B. rhizophagus* will infest healthy ones. The adult weevils feed in pairs on the leaves from November until February or March, and the eggs are laid on the leaves, between a pair gummed together in the case of *B. robustus*. The larvae enter the soil, tunnel along the surface of the larger roots and pupate and hibernate in an earthen cell. The adults emerge in spring and crawl up the trunks to the leaves. *B. robustus* can be controlled by collecting the adults and eggs or by a spray of lead arsenate (1 lb. in 8 gals.) applied when the adults are first seen. *B. rhizophagus* usually attacks larger numbers of trees and is much more difficult to control. The adults should be prevented from crawling up the trees by bands of wire gauze tied closely round the trunk, with the top 2–3 ins. bent over and back at an angle of about 45°, or by troughs, about 1–1½ ins. wide and deep, bolted closely round the trunk and filled with used lubricating oil.

Termites usually attack fruit trees in South Australia when the trunks have been wounded at or below ground level. Scarring the trees near the ground should be avoided, and any wound should be painted. If a colony becomes established in a tree, a hole should be made in one of the galleries and lead arsenate powder blown in, the aperture being immediately sealed. More soluble poisons, such as Paris green, should not be used, as they may kill the tree.

LEVER (R. J. A. W.). **Entomology Division. Annual Report for 1938.**—*Annu. Bull. divl Reps Dep. Agric. Fiji 1938* pp. 32–34. Suva, 1939.

Some of the information in this report on work in Fiji in 1938 has already been noticed [*R.A.E.*, A **26** 702; **27** 213, 366, 641]. The species of *Phaenocarpa* parasitising fruit-flies [*Dacus* (*Chaetodacus*) *passiflorae*, Frogg.] on Viti Levu and Taveuni Islands [*cf.* **27** 213] has recently been described as *Phaenocarpa leveri*, Nixon [**27** 605]. Various parasites of fruit-flies [*cf.* **27** 213] were shipped to Raratonga, western Samoa and Honolulu, the predacious Coccinellid, *Cryptognatha* [*nodiceps*, Mshl.] was sent to Hawaii for the control of *Pinnaspis buxi*, Bch., and *Pleurotropis parvulus*, Ferrière, was successfully sent to western Samoa for the control of *Promecotheca reichei*, Baly. *Bactra* *truculenta*, Meyr., and *Athesapeuta cyperi*, Mshl., were introduced from Hawaii in May against nutgrass, *Cyperus rotundus* [*cf.* **27** 367]. The introduced toad, *Bufo marinus*, distribution of which was continued, was found to feed on the banana borer, *Cosmopolites sordidus*, Germ. Miscellaneous pests observed included *Elytrurus* spp. on *Cassia* and *Piper* (*Macropiper*) [*methysticum*], *Euscepes postfasciatus*, Fairm., and *Cylas formicarius*, F., on sweet potato, and *Crocidolomia binotalis*, Zell., on cabbage. Living individuals of *Ahasverus advena*, Waltl, and *Oryzaephilus surinamensis*, L., both of which were already established in Fiji, were found in peach kernels from China.

DONALD (D. A.). **General Experiment Station, Sigatoka. Annual Report for 1938.**—*Annu. Bull. divl Reps Dep. Agric. Fiji 1938* pp. 77–93. Suva, 1939.

This report includes notes on insect pests observed in 1938 at the Sigatoka Experiment Station, on Viti Levu, in the Fiji Islands. Cotton planted in November and later was heavily infested by *Earias fabia*, Stoll, and, in some cases, the entire first crop of squares and young bolls was shed. *Dysdercus insularis*, Stål, was first observed in July, and the last two pickings of cotton were stained. Infestation by *Platyedra gossypiella*, Saund., was more widespread than in the previous season, but only late-maturing bolls were attacked. *Agrotis ypsilon*, Hfn., attacked tobacco throughout the growing period [*cf. R.A.E.*, A **27** 213] and also did extensive damage to cauliflowers, cabbage, tomato and other vegetables. It was controlled by constant cultivation, poison baits and hand-collection of eggs and larvae. *Plutella maculipennis*, Curt., on cabbage and cauliflower, was controlled by periodical dusting with a mixture of 1 part pyrethrum powder and 3 parts fine wood ash. The giant toad, *Bufo marinus*, liberated at the Station in the previous year, multiplied considerably, and reduced the numbers of slugs, millepedes and other pests.

VAN DER VECHT (J.). **De bestrijding van de klapperrups,** *Artona* (*Brachartona*) *catoxantha*, **door bespuiting met derris-suspensies.** [The Control of the Coconut Zygaenid, *A. catoxantha*, by Spraying with aqueous Suspensions of Derris.]—*Landbouw* **15** pp. 389–428, 6 pls., 7 refs. Buitenzorg, 1939 ; also as *Meded. algem. Proefst. Landb.* no. 36. Buitenzorg, 1939. (With a Summary in English.)

In Central Java, outbreaks of the coconut Zygaenid, *Artona catoxantha*, Hmps., sometimes continue for two or three years in native plantations of coconut. Up to 1933, control was restricted to cutting off and burning infested leaves [*cf. R.A.E.*, A **16** 576], though it was realised that chemical measures would be more satisfactory [*cf.* **16** 190]. As the natives grow food crops under the palms, the use of arsenical stomach poisons was considered dangerous, and a pyrethrum dust insecticide was tried [**22** 16 ; **25** 452]. In coconut plantations under European management where no such danger existed, F. E. Veeren in 1937 sprayed the palms cheaply and simply with lead arsenate by raising the spray nozzle on a support, with a long hose leading to the tank in which the spray was kept under pressure.

Investigations were carried out by the author on the possibility of using derris in a similar way. In the laboratory, 100 per cent. mortality of fourth-instar larvae of *A. catoxantha* was obtained with an aqueous suspension of derris, the spray containing 0·005 per cent. rotenone, and of full grown larvae with one of twice the strength. Furthermore, the spray residue on the leaves remained toxic for a considerable period, especially if 1–2 per cent. talc was added, apparently because it increased the adhesive qualities of the spray. The talc also rendered the residue more visible and was therefore used in all subsequent experiments. The results of the laboratory work are tabulated.

In four field tests, the pressure in the spray tank was pumped up to 4 atmospheres, and the spray nozzle, with which the lower surfaces of the leaves were sprayed by a man who had climbed up the palm, was connected to the sprayer by a 60 ft. rubber hose ; two hoses could be fixed to one sprayer. The nozzle aperture was about 1 mm. in diameter and delivered a jet producing large drops at some yards distance, this being necessary to reach the tips of the leaves, some of which were 5 yards long. The derris suspensions used, all with 2 per cent. talc, had rotenone contents of 0·015–0·03 per cent. The results indicated that spraying with such suspensions was more effective and cheaper than dusting. The highest palms were easily reached, strong winds were not so troublesome, the sprayers were easier to transport, and the work was more readily checked. In a further experiment, a derris suspension containing 0·03 per cent. rotenone was slightly superior to a 0·75 per cent. suspension of calcium arsenate, which caused some injury to the leaves.

Derris sprays were applied in a number of outbreak centres in Central Java in 1938, and some of this work is discussed in detail. In all areas a further increase of the damage was prevented by a single application, but two successive treatments were necessary to suppress some of the outbreaks completely. Spraying is now regularly practised, and a suspension containing 0·3 per cent. derris (rotenone content 10 per cent.) and 1½ per cent. talc is usually satisfactory, but in the wet season an increase of the derris to 0·4 per cent. appears advisable. The average quantity of spray required per palm is about 2 gals. and 15–20 palms can be treated in a day with one sprayer. The best results in the field tests were obtained when the entire infested area could be treated before the larvae pupated. Spraying during the pupal stage often caused a considerable reduction of the next generation, but in the rainy season this effect of the spray was not satisfactory.

The *Artona* populations remaining after spraying were usually controlled by the Eulophid larval parasite, *Euplectrus* sp., and by the Tachinids, *Cadurcia leefmansi*, Baranov, and *Ptychomyia remota*, Aldr. The Braconid, *Apanteles artonae,* Rohw., which also parasitises the larvae and is of considerable importance in checking slight infestations, was rarely abundant after spraying, apparently partly because when the *Artona* population has become sufficiently numerous to require control, this Braconid has already been overtaken by its own natural enemies.

[YAKHONTOV (V. V.).] **Яхонтов (В. В.). Peach Plantations under the Menace of Destruction.** [*In Russian.*]—*Inform. Byull. Karant. Rast.* [Inform. Bull. Plant Quar.] no. 4 pp. 7–9, 1 fig. Moscow, Izd. Sekt. Karant. Rast., 1939.

Lecanium (*Sphaerolecanium*) *unifasciatum*, Arch., has become very abundant on peach trees near Samarkand and in three other districts in Uzbekistan during the last five years and has caused a large number of the trees to wither and dry. A survey of the peach orchards in these districts in March 1939 showed that 60 per cent. of the peaches and 8·75 of the almonds were attacked. Rubbing the branches with a piece of fabric to remove the scales has not given effective control, as those on thin shoots or in rough bark escape, and infestation is soon re-established, owing to the enormous fertility of the females, which lay up to 1,500 eggs. Tests with insecticides should therefore be made, and those found suitable should be included in a programme of measures designed to eradicate infestation. This programme involves keeping the infested areas under quarantine, applying dormant sprays in late autumn or early in spring, rubbing the stems and branches of the trees in the second half of April or first half of May with rags wetted with a contact insecticide, and spraying with contact insecticides when newly hatched larvae appear.

[STEPANOV (E. M.).] **Степанов (E. M.). Pests of Azaleas and Rhododendrons—the Bugs** *Stephanitis* **as Quarantine Objects.** [*In Russian.*] —*Inform. Byull. Karant. Rast.* [Inform. Bull. Plant Quar.] no. 4 pp. 10–11. Moscow, Izd. Sekt. Karant. Rast., 1939.

Stephanitis pyrioides, Scott, was found in 1936, for the first time in the Russian Union, on rhododendrons that had been introduced from Yokohama in the previous year and were growing in the quarantine plant nursery in Poti (western Georgia). It has since persisted on rhododendrons and azaleas in the nursery; the larvae and adults occur on the lower surface of the leaves, on which they produce white transparent spots. The eggs are embedded in the tissues of the leaves. This Tingid may constitute a menace to the dense growths of *Rhododendron ponticum* in forests over a large area at the foot of the mountains in western Transcaucasia. Investigations there in 1939 showed that *R. ponticum* and *R. smirnovi* up to an altitude of 4,500 ft. were infested with an undescribed species of *Stephanitis*, which is widely distributed throughout the mountains of Transcaucasia. It is likely that this species may become established in greenhouses in various parts of the Russian Union, to which thousands of rhododendron bushes are sent yearly from the infested area. *S. rhododendroni*, Horv., has not as yet been observed in the Russian Union.

[SHUTOVA (N. N.).] **Шутова (Н. Н.). The Potato Moth** (*Phthorimaea operculella* **Zell.**). [*In Russian.*]—*Inform. Byull. Karant. Rast.* [Inform. Bull. Plant Quar.] no. 4 pp. 14–18, 4 figs., 1 ref. Moscow, Izd. Sekt. Karant. Rast., 1939.

Notes are given on the synonymy, distribution, bionomics and control of *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., which was found in and near the town of Poti on the Black Sea in 1938, in the leaves of single plants of tobacco, potato, tomato, egg-plant (*Solanum melongena*) and *Datura stramonium*. The different types of mines made by the larvae in the leaves are described. This moth has not previously been recorded in the Russian Union, and the infestation at Poti was eradicated by digging up the food-plants, wetting them with crude oil and burying them deeply, and then digging the soil to a depth of 6–8 ins. to destroy the pupae and pouring crude oil over it at the rate of 6½ pints per sq. yard.

Other Tineids of the same genus that had not previously been recorded from the Russian Union, but were discovered there in 1938, were *G.* (*P.*) *ocellatella*, Boyd, on beet and an unidentified species on *Hyoscyamus albus*, both in the Crimea ; and *G.* (*P.*) *epithymella*, Stdgr., larvae of which were abundant on the Black Sea coast between Sukhum and Sochi in the leaves of egg-plant, potato, tomato, ornamental tobacco plants, *S. nigrum* and *S. sysimbrifolium*. The larvae also damaged the fruits of egg-plant and in the laboratory penetrated into potato tubers. They were not observed on plantation tobacco, even when severely infested plants of potato or *S. nigrum* occurred in the vicinity.

VAN DEN BRANDE (J.). **Een belangrijke parasiet** (*Encarsia formosa* **Gahan) van de Witte Motjes** (*Trialeurodes vaporariorum* **Ww.**). [An important Parasite (*E. formosa*) of the Whitefly (*T. vaporariorum*).]—*Meded. LandbHoogesch. Opzoekingssta. Gent* **7** no. 3 pp. 280–287, 2 pls., 8 refs. Ghent, 1939. (With a Summary in French.)

Though of less importance than in England, where it is a serious pest of greenhouse tomatos, *Trialeurodes vaporariorum*, Westw., is abundant on flowering plants grown under glass in Belgium, and sometimes destroys such plants as primulas and calceolarias. A brief account is given of its biology. Fumigation with nicotine gives good control, but the most practical fumigant is Calcid [a form of calcium cyanide] ; the author states that it gives complete mortality of adults when used at the rate of 1·5 oz. per 10,000 cu. ft. under favourable conditions, the chief being that during the night of fumigation the temperature should rise from 14 to 25°C. [57·2 to 77°F.]. The State Experiment Station at Ghent has obtained supplies of the Aphelinid parasite, *Encarsia formosa*, Gah., from England and from another district in Belgium. When liberated on infested plants in a greenhouse, it rapidly became established, and gave complete control of the Aleurodid. It is now being bred for further distribution. Its morphology and life-history are briefly summarised from the literature [*cf. R.A.E.*, A **15** 240].

Entomological Field Station, Warburton, Cheshire. Report for the Year 1938.—*J. Lancs. agric. Soc.* 1939 repr. 35 pp., 6 figs., 6 refs. Preston, 1939.

The bulk of this report (pp. 8–35) is by H. W. Miles and M. Cohen and records the results of further investigations at Warburton (Cheshire) on the bionomics and control of wireworms [*cf. R.A.E.*, A **27** 96]. Adults of *Agriotes obscurus*, L., were abundant on the surface of the soil in April–June, when they were caught regularly in traps consisting of the dry roots of couch grass [*Agropyrum repens*] piled on arable plots, on paths and in hollows made in grass plots by removing pieces of turf. They preferred soil bearing grass or cereal crops where the temperature is comparatively constant, and were 1½ times as numerous on grassland as on ploughed land. Apart from a single example of *A. lineatus*, L., *A. obscurus*, the sexes of which occurred in approximately equal numbers, *Hypnoidus* (*Cryptohypnus*) *riparius*, F., and *Athous obscurus*, Payk. (*haemorrhoidalis*, F.) comprised

88, 10 and 2 per cent., respectively, of the total number of adults trapped during the season. *Agriotes obscurus*, *A. lineatus* and *H. riparius* were active only by night ; in captivity, they fed on leaves of cereals. *Athous obscurus*, which did not feed on cereals, occurred among the flower-heads and foliage of umbelliferous weeds. The feeding period of the adults extended throughout April and the first half of May, and mating occurred during the last two weeks of this period.

Eggs of *Agriotes obscurus* and *Athous obscurus* were observed between 14th May and 14th June, and 21st May and 10th June, respectively, and females of *H. riparius* began to oviposit on 30th April. Eggs of *Agriotes obscurus* occasionally were deposited singly, but most frequently in small groups of 2–10 ; under laboratory conditions they occurred just below the surface of the soil, but in the field they may be deposited as deep as 2 ins. in cracks in the soil round the plants. As females in the laboratory oviposited on a moist, but not on a dry soil, their preference in the field for soil covered by herbage is probably due to the moist conditions prevailing there [*cf.* **28** 156] ; on fallow land advantage is taken of the more humid conditions in deep cracks.

Observations were made on the immature stages of *Agriotes obscurus*. The incubation period varied from 53 days early in the season when the temperature was low to 38 days when it was higher. The larvae moulted in August when a month old, and some moulted again in October. During the winter, larvae in the second and third instars fed on the roots of germinating wheat and on the rhizomes of couch grass, but although these were pierced with small holes and galleries, the larvae do not cause serious damage to crops within 7–8 months of hatching. Larvae collected at the end of June moulted about the end of the first week of July. Pupae were present in the soil during the last half of July and development was completed during August. Of a total of 4,700 larvae collected during the year, *Agriotes obscurus*, *Athous obscurus* and *H. riparius* comprised 98, 1·8 and 0·2 per cent., respectively.

Preliminary laboratory tests were carried out with a number of soil insecticides, including two mustard by-products, which consisted largely of plant material with a small proportion of mustard oil (allyl isothiocyanate) and of which the more promising was mustard dross (0·73 per cent. allyl isothiocyanate) ; naphthalene ; carbon bisulphide ; calcium cyanamide ; a stock emulsion prepared by dissolving flake naphthalene in carbon bisulphide and slowly pouring it into water containing a small quantity of sulphonated castor oil ; and a number of thiocyanate emulsions. Sufficient wireworm mortality to justify further trials was obtained with mustard dross applied at rates of 1 ton or more per acre ; any good effects observed to follow its use at much lower rates are probably due to stimulation of the plants. A mixture of mustard dross and naphthalene, at the respective rates of 2 tons and ½ ton per acre, was more effective and rapid in action. Naphthalene adsorbed in powdered fuller's earth (to make it more easily distributed) was not toxic, even at the rate of 3·2 cwt. naphthalene per acre [*cf.* **27** 97], but this preparation gave satisfactory results when used as a carrier for carbon bisulphide. An emulsion containing 10 per cent. carbon bisulphide and 0·7 per cent. naphthalene per gallon was highly toxic when applied at the rate of 1 gal. per sq. yd. and was more effective than any of the thiocyanate emulsions. Calcium cyanamide appeared to have no direct effect on wireworms.

Field trials with the mixture of mustard dross and naphthalene ($2\frac{1}{2}$ tons per acre), mixtures of fuller's earth containing 13·66 per cent. naphthalene and either 10–12 per cent. carbon bisulphide or 5–6 per cent. cyanide (1 ton per acre), and the carbon bisulphide and naphthalene emulsion (1 gal. per sq. yd.) were made on plots bearing four varieties of potato. A table shows the index of wireworm infestation and the percentage of tuber injury in plots receiving each treatment; although complete statistical analysis of the results was impossible, the data obtained established that none of the four treatments has a deleterious effect on the growth of the plants, on the size or quality of the tubers or on the yield. The first three treatments reduced the amount of serious injury to the tubers; all three mixtures are easily applied.

Preliminary observations on the susceptibility to attack of four early, four second early and four main-crop varieties of potato demonstrated the existence of varietal differences within each group. A table shows the percentage of damaged tubers of each variety and the percentage that contained deep holes, which is regarded as the index of susceptibility.

Carrots, flax, peas, various pot-herbs and seedling salsify and sugar-beet were not injured by wireworms during 1938, but there was slight damage to salsify in late autumn. Injury to asparagus sown in late spring became apparent in August, when 2–3 per cent. of the plants were completely destroyed, and to chicory in October, when 4 per cent. of the mature plants lifted for forcing were infested; about 16 per cent. of the swede crop was attacked. Of cabbage and cauliflower plants, 29 per cent. became infested after planting out, but few were killed by wireworms unless they were attacked simultaneously by the mealy cabbage aphis [*Brevicoryne brassicae*, L.], or the cabbage root fly [*Hylemyia brassicae*, Bch.] or by club root. When cabbage was interplanted with rows of wheat, the average number of larvae per plant was 2, whereas in 18-in. lengths of wheat row it was 5. Cabbage lettuce was not injured, but two plots of cos lettuce were completely destroyed three times running, as many as 6 larvae being observed in a single plant. Of the crop obtained after three replantings, one third was destroyed and another third infested. Of onions, 50 per cent. were injured or destroyed.

Methods of breaking up grassland for different crops [**27** 97; **28** 106, 156] are discussed.

QUANJER (H. M.). **De Perzikbladluis, een gevaar voor de cultuur van aardappelen en andere gewassen.** [The Peach Aphid, a Danger to the Cultivation of Potatoes and other Plants.]—*Tijdschr. PlZiekt.* **45** pt. 5 pp. 224–232, 12 refs. Wageningen, 1939.

In view of severe infestation of potatoes in fields and orchards in Holland by Aphids in 1939 and the importance of *Myzus persicae*, Sulz., as a vector of virus diseases of potato, an account of the biology of this species is given from the literature, mainly from papers already noticed [*R.A.E.*, A **23** 492; **27** 267, 578]. With reference to competition in the export of seed potatoes between Holland and countries where *M. persicae* does not occur, the author refers to a report on potato growing and degeneration diseases in Estonia presented by Walter Roots at the 18th Agricultural Congress, Dresden, 1939. Roots stated that serious virus disease of potatoes is very rare in

Estonia because *M. persicae* does not occur in potato fields, though it has been found on peach under glass. The average annual temperature in Estonia is 4·9°C. [40·82°F.], the temperature rises above 10°C. [50°F.] during only 4 months in the year, and July and August are the only months without night frosts.

BARANOV (N.). **Maslinova mušica. (Prvi deo.)** [The Olive Fly. (First Part.)]—*Arkh. Min. Pol'oprivr.* **6** no. 16 pp. 3–26, 1 col. pl., 6 graphs. Belgrade, 1939. (With a Summary in German.)

The author has been making investigations for several years on *Dacus oleae*, Gmel., and the Tineid, *Prays oleellus*, F., which are the chief pests of olives in Dalmatia, and here gives a detailed account of the bionomics of *D. oleae* as observed in 1934–38 in the northern part of the island of Pago and in the environs of Dubrovnik, and particularly of the factors that govern its mass increase. Some of the information has already been noticed [*R.A.E.*, A **25** 536]. All stages are described, the adults and larvae at some length. The thermal constant for development of this Trypetid is 340 day-degrees C. [612 F.] and the lower threshold 9·3°C. [48·74°F.] ; it occurs in Jugoslavia wherever olives are cultivated. The adults live for up to two months in summer and considerably longer in winter. They feed on honey-dew from Coccids on bay (*Laurus nobilis*), the sweet exudation on the ripe fruits of figs and the nectar of the flowers of carobs (*Ceratonia siliqua*), particularly during the period that precedes pairing, which takes place 6–10 days after emergence in summer, but apparently does not occur in winter. The females oviposit throughout their life, laying 10–12 eggs daily in the olive fruits. The process of oviposition is described. The egg, larval and pupal stages last 2–4, 10–14 and about 10 days, respectively, in summer, and pupation takes place in the soil or in unripe fruits.

Observations on fluctuations in the number of adults between July and the end of November were carried out yearly by catching them in jars containing the same poison bait as was used for *P. oleellus* [**28** 38]. The flies were attracted to the traps from distances of about 3 ft., and approximately equal numbers were caught in each container, irrespective of its size or whether several or one only was suspended in the olive tree. They were most active in the evening before sunset, and during the peak of the flight up to 300 were caught daily in each vessel. The investigation showed that their abundance differs in individual localities and years and that the curves representing it deviate from the theoretical curve corresponding to the normal development of the fly under optimum conditions in a given locality. The latter has one peak about the end of August and is characterised by a sharp rise and a gradual decline. The deviations from it are due to various factors, which are discussed ; they include the occurrence of a diapause in the pupal or adult stage ; weather conditions in spring and during the oviposition period ; the availability of food for adults and larvae ; and diseases and parasites.

Oviposition in cultivated olives practically ceases in September, but some of the females migrate to and oviposit in wild olives. The resulting larvae pupate in the soil, and some of these pupae diapause and do not give rise to adults until the following summer or autumn. The pupae that do not diapause give rise to adults from December to the beginning of April, and flies that emerge in the winter months diapause, as was demonstrated in the laboratory when winter adults kept at 20–22°C. [68–71·6°F.] and provided with food did not pair or lay eggs for three months. Larvae that develop in cultivated olives in autumn only rarely abandon them for pupation, and it is doubtful whether they ever give rise to pupae that diapause. The olive trees become infested in the last ten days of June or beginning of July by flies that emerge in winter or spring, and the abundance of these flies depends on weather conditions, since sharp fluctuations of temperature in spring, copious rainfall or excessive humidity are fatal to the pupae and adults and mortality increases if the period between adult emergence and the development of olive fruits is prolonged. The intensity of oviposition depends on adult feeding and, consequently, on the presence in or near the plantations of fig, bay or carob trees. In laboratory observations, the adults were torpid at 6°C. [42·8°F.], began to crawl about at 12·2°C. [53·96°F.], showed increased activity at 25°C. [77°F.], became abnormally active at 40°C. [104°F.], and died from paralysis at 46°C. [114·8°F.].

The larvae were parasitised by *Eupelmus urozonus*, Dalm., and *Eulophus longulus*, Zett., but these parasites are not considered of much value. In November 1938, 98 per cent. of the larvae in wild olives in the north of the island of Pago were parasitised by *E. longulus*, but parasitism by either species in the plantations occurred only in August. A Microsporidian, which caused high mortality among all stages of the fly and sterility in the surviving females, was of much greater importance.

HILL (C. C.), PINCKNEY (J. S.) & UDINE (E. J.). **Status and relative Importance of the Parasites of the Hessian Fly in the Atlantic States.**—*Tech. Bull. U.S. Dep. Agric.* no. 689, 15 pp., 2 refs. Washington, D.C., 1939.

In this paper on the parasites of *Mayetiola* (*Phytophaga*) *destructor*, Say, in the eastern United States, the information given in a previous account [*R.A.E.*, A **16** 439] is revised and supplemented. Of the 18 parasites recorded, 5 were individually of importance, and by far the most effective of these were the Scelionids, *Platygaster hiemalis*, Forbes, and *P. zosine*, Wlk. (*vernalis*, Myers), and the Eupelmid, *Eupelmus allyni*, French. In addition, *P. herricki*, Pack., was of significance in view of its activity in southern and western districts, and the Pteromalid, *Merisus destructor*, Say, because of its widespread distribution and persistent though moderate abundance. The investigations showed that the average annual percentage parasitism of puparia of the spring generation of *Mayetiola*, which represented about two-thirds of the total mortality from all causes, was about 62 in the wheat-growing districts of western New York, 63 in those of Pennsylvania, Maryland and northern Virginia and 47 in southern Virginia and North Carolina. The total mortality was somewhat less in New York than in the central region, and both parasitism and mortality were much lower in southern Virginia and North Carolina, possibly because, of the three parasites most active in the north, *P. zosine* was absent and *E. allyni* much less abundant.

P. hiemalis is the only effective parasite of the autumn generation of *Mayetiola*, to which it is specific, and is widely distributed [*cf. loc.*

cit.]. The average annual percentage parasitism by it was highest (43) in western New York, and lowest (8) in North Carolina. It parasitises a small percentage of the spring generation in northern New York, and has occasionally been bred from this generation in other eastern districts. *P. zosine* is of most importance in the north-eastern region. The adults overwinter and oviposit in spring in the eggs of *Mayetiola*; 2–12 embryos may develop from a single egg, and the number of adults produced per host averages 8. Mortality in the immature stages is high, partly owing to the premature death of the host, and partly to destruction of the larvae by later developing Chalcidoid parasites, many of which oviposit throughout the summer. Owing, however, to its high rate of reproduction and the vulnerable stage in which the host is attacked, it has maintained its abundance. The eggs are present throughout May, the larvae between late May and early July, and the pupae between July and September. The larvae spin their cocoons during June and July and pupate in July or August, and the pupae usually transform into adults by the end of September, though these almost invariably remain in the cocoons until spring. Observations at the end of the season, when much evidence of parasitism had been obliterated, showed that the average percentage parasitism by *P. zosine* of the spring generation of *Mayetiola* was 22·52 in western New York, 13·21 in the central region and 0·21 in the south.

E. allyni is a solitary external parasite and is not specific to *Mayetiola*. Its eggs are monoembryonic and are deposited in the host puparium. It has more than one generation a year, overwinters in the larval stage and is most effective at the end of the season. It may prove to be the most valuable of all the parasites, owing to its wide distribution and consistently high rate of parasitism. At the end of the season the percentages of parasitism of the spring generation of *Mayetiola* in western New York and in the central and southern regions averaged 20·63, 29·23 and 19·43 by *E. allyni*, and 2·52, 4·71 and 5·27 by *Merisus destructor*; that by *P. herricki* in the southern region averaged 5·75 [*cf.* **26** 121]. *Merisus destructor* is a solitary external parasite of *Mayetiola* and is similar in habits to *E. allyni*. In Pennsylvania and Maryland active parasitism by it begins shortly before mid-June, and it reaches its greatest abundance in September.

Merisus febriculosus, Gir., the Eulophids, *Tetrastichus carinatus*, Forbes, and *Pleurotropis metallica*, Nees, and the Eupelmid, *Eupelmella vesicularis*, Retz., are of value only when regarded as a whole or when any of them becomes abundant for a season in some restricted locality. *M. febriculosus* resembles *M. destructor* in habits, but the Eulophids are internal parasites and attack *Mayetiola* earlier in the season than the other Chalcidoids, preferring to oviposit in the host larvae prior to the formation of puparia. *T. carinatus* sometimes has a second generation in late summer, the adults of which oviposit in a late summer or autumn generation of *Mayetiola* in self-sown wheat. Only very brief notes are given on the other 9 parasites recorded, all of which were rare.

Observations in the plain of the St. Lawrence in northern New York showed that *P. zosine* and *P. hiemalis* were present only in insignificant numbers, and that *E. allyni* was much less abundant than further south. In two localities, *M. febriculosus* and *P. metallica* were more important than in more southerly regions, and in another *T. carinatus* was by far the most important parasite attacking *Mayetiola*.

TUCKER (R. W. E.). **Some Aspects of the Control of the Sugarcane Moth Borer,** *Diatraea saccharalis* **F.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 240–243. Baton Rouge, La., 1939.

The author briefly reviews some aspects of the control of *Diatraea saccharalis*, F., on sugar-cane, particularly by means of its parasites. In Barbados, where *Trichogramma minutum*, Riley, is present in nearly all districts, the large-scale mass breeding and early liberation of this egg-parasite reduces loss by 50 per cent. In the author's opinion, *T. minutum* is the principal natural factor in the control of *D. saccharalis*, and if it were absent, the cultivation of sugar-cane would be economically impracticable in some countries. The existence of a definite relationship between borer infestation and cane varieties has been established, but the raising of varieties resistant to *Diatraea* has not yet been employed as a method of control in Barbados.

It is considered that any assessment of damage used to estimate the value of a control measure should conform to definite standards. The method of assessment employed in Barbados is described.

HOLLOWAY (T. E.). **Introductions and Recoveries of Parasites of Sugarcane Insects in Continental United States.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 258–263. Baton Rouge, La., 1939.

A list is given of all the parasites that have been introduced into the United States for the control of pests of sugar-cane, and work on them is briefly reviewed. They comprise *Pseudococcobius terryi*, Fullaway, successfully established against *Pseudococcus boninsis*, Kuw. [*R.A.E.*, A **26** 137]; *Campsomeris dorsata*, F., introduced from Porto Rico in 1934 and released against *Euetheola rugiceps*, Lec., but not recovered; and 17 parasites or potential parasites of *Diatraea saccharalis*, F. Information on 8 of these has already been noticed [**17** 465; **26** 137, 390, **27** 656, 658]; the others comprise 7 insect parasites and the fungus, *Cordyceps barberi*, work with all of which was unsuccessful, and *Metagonistylum minense*, Tns., which was introduced in 1938 from Porto Rico, reared in the laboratory and released in Louisiana.

When larvae of *D. saccharalis* inoculated with larvae of *M. minense* [*cf.* **22** 388] were each kept in a separate section of sugar-cane, about 1,850 adult parasites were obtained from 1,650 host larvae, but this technique was laborious and another was devised in which inoculated larvae were kept in galvanised iron pans, with screened tops and containing shavings of maize or sugar-cane; when the parasites pupated, the pans were placed in wire cages. From a pan containing 50 host larvae, 51 parasites were obtained. On emergence, the adult parasites were transferred to mating and storage cages, provided with cotton soaked in water or sugar solution. In order to reduce the activity of the adults and prolong their lives, the mating cages were kept humid and comparatively dark during summer by placing them under a black cloth supported over a framework and with the edge dipping into water.

Seven generations of *Metagonistylum* were reared in the laboratory, and it was liberated in several localities in Louisiana. Recoveries have already been made. In one isolated field it had killed about 48 per cent. of the larvae of *Diatraea*, and it was recovered in another plantation at a distance of about a mile from the point of liberation.

DUGAS (A. L.). **Trend in Natural Parasitism of Sugarcane Borer,** *Diatraea saccharalis* **(F.), by** *Trichogramma* **spp.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 361–367. Baton Rouge, La., 1939.

During 1931–34 marked benefits were obtained in the control of *Diatraea saccharalis*, F., on sugar-cane in Louisiana by artificial colonisation of *Trichogramma*, but during 1934–38 there was in many instances little or no difference in the percentage parasitism in colonised and uncolonised fields. In view of this, a partial analysis is given of extensive data on natural parasitism in fields far enough from colonised areas to be unaffected by the spread of parasites from them, the extent of oviposition by the host and variations in the size of the host egg masses, collected in the years 1928–38 in the southern cane area of Louisiana.

Tables show, for each of four generations and for the total collecting period (April–September) during each year of the survey, the total numbers of eggs of *D. saccharalis*, the numbers and percentages parasitised, and the numbers of egg masses, of man-hours of collecting and of egg-masses collected per man-hour, and all these figures separately for cane and maize. In the years prior to 1934, the highest percentages of parasitism (combining figures for cane and maize) in the first, second, third and fourth generations were 5·9 in 1932, 25·0 in 1929, 27·1 in 1932 and 62·3 in 1929, respectively, whereas in 1938 the percentages were 18·1, 55·0, 71·7 and 86·2, and a similar increase, except in the first generation, is shown in the data for the previous three years. Second-generation eggs were more abundant on maize than on cane during 1935, 1936 and 1938, and parasitism on it was exceptionally high.

The number of egg-masses of *Diatraea* collected per man-hour is considered to be an accurate comparative measure of the extent of oviposition, and estimates were made in this way in 1930–38. Oviposition is apparently limited during April, and increases steadily until it reaches a maximum in October. It was low throughout 1931 but increased during 1934, after which there was a marked decline, especially in the numbers of fourth-generation eggs, which, however, show a decided increase in abundance over those of the third generation in years of high infestation. The egg-masses on cane contained an average of 4 eggs more per mass than those on maize, and on several occasions average differences of more than 10 were observed ; the average on maize exceeded that on cane in only three generations, in 1929, 1931 and 1938.

Natural parasitism by *Trichogramma* is low in April, when the host eggs are scarce ; eggs of *Diatraea* are at that time laid in approximately equal numbers on cane and maize, but more occur on maize in late May and natural parasitism is then slightly higher on maize. Oviposition increases steadily from June, but is sometimes temporarily checked by hot dry weather ; second- and third-generation eggs are deposited more abundantly on maize, which begins to dry out at the end of July after most of the third-generation eggs have been laid. Parasitism also increases after June, reaching a maximum in October. Before 1935, control by natural parasitism was negligible during April–June and significant gains were obtained from artificial colonisation, but owing to the increase in natural parasitism, only those fields in which the parasite population is low are now expected to receive marked benefit from this measure.

Infestation by *Diatraea* appears to have decreased since 1935, and this may be the result of heavy parasitism. Large-scale liberations of *Trichogramma* may not be responsible for the present state of high natural parasitism, but contributing factors may be the introduction by chance or as a result of laboratory rearings of a hardier strain of parasite that is able to survive the winter, favourable weather conditions, which may have increased the possibility of survival, and the increased numbers of eggs of alternative hosts available during critical periods, owing to the more extensive planting of summer and winter leguminous crops. The introduction of resistant varieties of cane has also assisted in reducing damage by *Diatraea*.

SMYTH (E. G.). *Trichogramma* **proves itself in Sugarcane Borer Control.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 367–377, 3 figs. Baton Rouge, La., 1939.

An account is given of the conclusions reached as a result of mass liberations over a number of years of *Trichogramma* against *Diatraea saccharalis*, F., on a sugar-cane plantation in northern Peru, illustrated by reference to data collected during 1930–31, when only part of the plantation was colonised and fewer parasites than usual were released.

The topography and climate of the plantation are described and the method of checking the results is explained. During the work, it was established that on the Peruvian coast the dispersal of *Trichogramma* takes place only towards the north at an approximate rate of 1 mile per month, since it is effected almost entirely by a constant southerly wind with a fairly uniform velocity during daytime. This factor was taken into account in the liberations that were made. Where the degree of infestation is variable, or the continuity of the cane-fields is broken to leeward of the point of liberation, the parasites should be liberated at a minimum rate of 5,000 per acre. The effectiveness of the colonisation in reducing borer damage depends on a number of factors, including the season at which liberations are made, the age of the cane, the number of host eggs present, the extent to which the fields are protected from wind and dust, the velocity of the wind, and other weather conditions. Releases are best made when the cane is 3–4 ft. high and about three months old, but they can be made earlier if infestation is severe. The proportion of parasitised eggs affords a criterion of the success of the measure, since under normal conditions the ultimate yield of sugar per ton of cane varies inversely with the borer damage, and this is inversely proportional to the seasonal egg parasitism.

On the plantation under consideration, the cane is burned before harvest, which destroys all the *Trichogramma* present, and recolonisation is too slow to be effective unless aided by artificial means. In one case, colonisation from a single point of release extended 8 miles northward in less than a year, and during this period there were 20 generations of *Trichogramma*, each occupying 8–12 days. Parasites were liberated at the average rate of 2,500 per acre between September 1930 and February 1931, most being released during December. The results are shown in detail in graphs and tables, and indicate that the percentage parasitism was lowest in October in fields that were colonised, and in November in fields that were not, and highest in both groups in May. The percentages of eggs of *Diatraea* parasitised were 30 in uncolonised fields and 60 in colonised, including those to which the parasite was carried by wind. In a high percentage of colonised fields, the borer damage was less than 30 per cent., and the sucrose content, sugar ratio and purity of the juice of the cane exceeded 12·5, 11 and 79 per cent., respectively. Equally good results were obtained from only one of the uncolonised fields, and as it was situated less than a mile from a colonised field, it probably received parasites by migration.

In a discussion of these results it is stated that under normal conditions of growth, the sucrose content and purity of the juice vary inversely with the amount of borer damage, though the purity is also affected by other factors. The sugar ratio varies with the sucrose content and purity, and is therefore increased by borer control, but is also influenced to some extent by the general vitality of the cane. Borer damage has no effect on cane tonnage, since it results in increased flow of sap or in the production of new shoots that may even increase the weight of the stool, though resulting in inferior juice and lowered sugar content. The sugar yield is partly influenced by borer damage since this affects the sugar ratio ; in all the colonised fields it was high in relation to the cane tonnage, reaching a maximum in those fields that were colonised from the breeding grounds, whereas it was low in uncolonised fields.

The cost of control of *D. saccharalis* by *Trichogramma* on this plantation is discussed ; the average gain in sugar is estimated to be 21·4 lb. per ton of cane.

JEPSON (W. F.) & MOUTIA (L. A.). **The Progress of Applied Entomology in Mauritius during the Years 1933 to 1938, with Reference to Insects of the Sugarcane.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 377–382, 5 refs. Baton Rouge, La., 1939.

The principal features with respect to pests of sugar-cane in Mauritius in 1933–38 were an extension of the range of *Lachnosterna* (*Phytalus*) *smithi*, Arr., in the central, southern and eastern parts of the Island, a decrease in infestation by it in the north, and an increase in the damage due to the moth borers, *Diatraea venosata*, Wlk., and *Eucosma* (*Olethreutes*) *schistaceana*, Sn.

Hand collection of *L. smithi* has been discontinued [*cf. R.A.E.*, A **26** 176, 316] ; other direct control measures, such as burning a thick layer of trash on the fields before planting, while the adults are active, and the application of white arsenic at the rate of 75 lb. per acre, which is the highest rate at which it can economically be applied, are ineffective, and the practice of covering newly planted cane with a layer of trash [**24** 666] is here stated to be valueless as a deterrent to oviposition. The only measures available appear to be the use of resistant varieties of sugar-cane, and biological control by imported parasites and predators ; work on the latter is briefly summarised, and a list is given of those imported during 1933–38. They comprise 27 Scoliids and 9 other parasites and predators. Of these, *Campsomeris pilosella*, Sauss., and *C. phalerata*, Sauss., are now established in nearly every infested cane-field [*cf.* **26** 317], the latter being extremely abundant, even during winter. The degree of control to be attributed to them is difficult to assess, as parasitised larvae occur only deep in the soil, but it appears to be considerable, since groups of as many as 20–30 male Scoliids frequently occur on the flower-heads of weeds in cane-fields.

Diatraea venosata attacks young and maturing canes [*cf.* **22** 259]. The native parasites are unable to check this borer, which in dry seasons becomes of serious importance in coastal areas, and the practice of cutting out dead-hearts, though sometimes successful, is unreliable.

Nomadacris septemfasciata, Serv., has been of minor importance since 1934, chiefly owing to the mynah bird, *Acridotheres tristis* [**24** 240]. The Muscid, *Stomatorrhina lunata*, F., which destroy the eggs, has recently become very common in cane-fields, but its influence on *Nomadacris* has not been determined. Larvae of the Dynastid, *Oryctes tarandus*, Ol., still occur locally at the rate of about 2,000 per acre, but appear to be held in check by *Scolia oryctophaga*, Coq. *Perkinsiella saccharicida*, Kirk. [*cf.* **26** 454] occurs fairly frequently on sugar-cane, but has not caused damage. *Aphis sacchari*, Zehnt., which is fostered by *Technomyrmex detorquens*, Wlk., is very common. A recent outbreak of this Aphid, during which canes were killed by a sooty mould that developed on the infested leaves, was checked by an entomogenous fungus and the Coccinellid, *Cydonia* (*Chilomenes*) *lunata*, F., at the beginning of the cool season in May. *A. maidis*, Fitch, is common on maize, but rarely attacks sugar-cane ; mosaic of cane does not occur in Mauritius. *Gryllotalpa africana*, P. de B., has caused severe local damage to cane ; baits of Paris green and bran have not afforded any appreciable control. *Chionaspis* (*Aulacaspis*) *tegalensis*, Zehnt., which forms a compact white crust over the stalks and leaf bases of maturing cane, was known for many years to occur in Mauritius, but damage due to it was not prominent until 1937 and 1938, when, however, the infested areas covered only a few acres. Measures for its control are restricted to burning and cutting the fields as early as possible in the grinding season. The Coccinellid, *Lindorus lophanthae*, Blaisd., is predacious on this Coccid, but does not afford complete control ; exuviae of *Chilocorus politus*, Muls., which was imported from Java for the control of *Aspidiotus destructor*, Sign., on coconut [**26** 204], have been observed in cane-fields infested by *C. tegalensis*.

In April 1938, leaf-rolling larvae of the Pyralid genus *Marasmia* were observed in the hearts of young shoots arising from the stools of maturing ratoon canes. The upper surface of the unfolding leaves was eaten away and the edges glued together, and the injury was frequently followed by chlorosis and the destruction of the enclosed shoot. In some cases, the developing shoot penetrated the surrounding affected leaf. The larvae also occur on rice, to which they do not appear to cause economic injury, and on a number of wild grasses.

BARTLETT (K. A.). **The Introduction of Predatory Beetles into Puerto Rico to aid in the Control of the Yellow Cane Aphid,** *Sipha flava*.—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 383–385, 2 refs. Baton Rouge, La., 1939.

Sipha flava, Forbes, is a common pest of sugar-cane in Porto Rico, where it damages young plants during the dry season or during prolonged drought and sometimes renders replanting necessary. Injury is caused by colonies feeding on the lower surfaces of the leaves, which turn first yellow, then red and finally brown. The combined action of climatic factors, the entomogenous fungus, *Acrostalagmus aphidum*, and insect predators, which comprise the Coccinellids, *Cycloneda sanguinea* var. *limbifera*, Casey, *Ceratomegilla* (*Megilla*) *innotata*, Muls., *Scymnus roseicollis*, Muls., *S. loewi*, Muls., and *Hyperaspis* sp., the Chrysopid, *Chrysopa collaris*, Schneider, and an undescribed Syrphid of the genus *Ocyptamus*, usually reduce outbreaks within a reasonable period, but since considerable damage may be done first, an attempt was made to supplement natural control by the introduction of the Coccinellids, *Coelophora inaequalis*, F., and *Scymnodes* (*Platyomus*) *lividigaster*, Muls., from Hawaii. Both had been imported into Hawaii from Australia.

Two shipments of *C. inaequalis*, comprising 102 living adults, were received, and it was bred in the laboratory. Eggs were deposited on leaves of sugar-cane in groups of up to 30–40, and hatched in 2–4 days. The larvae fed readily on Aphids, but were confined separately since they also attacked each other; there were four larval instars. Development from egg to adult lasted 12–16 days, and mating and oviposition occurred 3–5 and 4–5 days, respectively, after emergence. The largest number of eggs deposited at one time by a single female was 43, the average number being 15·5. Adults lived for as long as 2–3 months in captivity, and the number of depositions of eggs was approximately one-half the number of days that a female lived. Liberations were made in several districts throughout the island, under different environmental conditions, and larvae, pupae and adults were recovered from all within a few months. One liberation of 68 adults of *S. lividigaster* was made, but no recoveries were made. Attempts to rear it in the laboratory were unsuccessful.

EDDY (C. O.). **An Attempt to colonise** ***Hippodamia convergens***.—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 385–386. Baton Rouge, La., 1939.

A collection of overwintered adults of *Hippodamia convergens*, Guér., including 10–15 per cent. of var. *ambigua*, Lec., and comprising 1,000,000 individuals, was made in the mountains in California on 11th March 1938, placed in cold storage at 40°F. until 28th March and then transported in refrigerator cars to a district in Louisiana where it was again placed in cold storage. The beetles were sprayed with water weekly during the whole storage period. Releases were made on 13th May and 22nd June in a field containing sugar-cane grown for seed to determine the effectiveness of the predators in preventing the spread [by Aphids] of mosaic disease [*R.A.E.*, A **28** 250], and 25 per cent. were then found to be dead. On liberation the beetles quickly dispersed and after a fortnight had nearly all disappeared.

A second collection of adults of *H. convergens* that had just arrived in the mountains was made on 13th June and kept in cold storage in Louisiana for about a month before the beetles were released on 16th August. All had left the field after three days.

CLAUSEN (C. P.). **Some Phases of Biological Control Work applicable to Sugarcane Insect Problems.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 421–426. Baton Rouge, La., 1939.

When parasites are to be imported into a country against an introduced pest, they have usually been collected in a single locality where their host or hosts are relatively abundant and they are most easily obtained. Evidence is now accumulating, however, to show the existence, among hosts and parasites, of distinct geographical and physiological strains, characterised by differences in reproductive capacity, greater or less synchronisation of life-cycles, etc. Such strains are most likely to be found in a species that occurs in temperate or sub-tropical regions, where the range of climatic factors is wide, and the suitability of a parasite for establishment in a new area may depend upon its strain [*cf. R.A.E.*, A **26** 324 ; **27** 377]. Collections should therefore be made over the whole geographical range of the species, including areas where the host is scarce, since its scarcity may be due to the effectiveness of the parasite. In tropical regions, where the generations of the host usually overlap throughout the year, lack of synchronisation between the life-cycles of host and parasite is unlikely to occur, but strains of a parasite may differ in their climatic requirements and rainfall appears to be the most important factor [*cf.* **26** 82 ; **27** 143].

In the case of some parasites or predators, it is necessary or more economical to import the whole supply to be released ; most species can be reared in the insectary, however, and the process is more simple and efficient and its cost is considerably reduced if a suitable alternate host can be used, as it is in the mass rearing of *Trichogramma*. Successive generations of several species of *Microbracon* and of all species of *Chelonus* so far tested can be obtained every 4–6 weeks by employing larvae of the Mediterranean flour moth [*Ephestia kuehniella*, Zell.], a host that they never encounter in nature, the cost of production being reduced to 1 per cent. of that when the normal host is used. This method is probably limited to species that are ectoparasitic on larvae and to those that oviposit in the eggs of their host.

The method of colonisation must be adapted to the species. Where the host is present over a wide range, liberations should be made as early as possible in each of the principal sections, since one may provide optimum conditions and thus permit immediate establishment. Distribution over the whole infested area should be completed at the earliest possible date. Releases over a period of three years are believed to be sufficient to enable a parasite or predator to become established in temperate regions, since species that have later been of appreciable value have invariably been easily established. In tropical regions, releases over one year are probably sufficient. The numbers of individuals released at a given site should not be very small, but it is more desirable to ensure that they have paired before release than to liberate very large numbers. Effective species quickly demonstrate their capabilities, and may be expected to afford control at the point of liberation within a period set arbitrarily at three host generations, and throughout the infestation in two years.

Many native parasites and predators are very limited in distribution, although conditions are favourable for them over a wide area, in which they can be successfully liberated. Parasites that have been used in this way in the United States are *Aphelinus mali*, Hald., against the woolly apple aphis [*Eriosoma lanigerum*, Hsm.], and *Macrocentrus ancylivorus*, Rohw., against *Cydia molesta*, Busck. *M. ancylivorus* and *C. molesta* also illustrate the fact that a native parasite may be more effective against an imported pest than are imported parasites that attacked it in its country of origin. In a brief discussion of the value of the native egg parasite, *Trichogramma*, in the control of *Diatraea*, the author states that the evidence of its value in tropical regions is inconclusive and that mass liberations early in the season do not appear to increase its effectiveness in temperate regions.

The evaluation of the results of partial biological control in terms of crop injury is very difficult. In some cases, mortality due to a parasite may merely replace that due to other factors. In general, conclusions must be based upon data on field injury by the host species that have been collected over a period sufficiently long to permit normal fluctuations in the host population. In problems involving a series of imported natural enemies, the large expenditure required to secure a quantitative determination of results can seldom be justified, as the knowledge acquired cannot be applied in any way to secure a greater degree of effectiveness.

OSTERBERGER (B. A.) & CHRISTIAN (M. B.). **Biology and Importance of the Sugarcane Rootstock Weevil** (*Anacentrinus subnudus* **Buch.**) **in Louisiana.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 472–475, 7 refs. Baton Rouge, La., 1939.

Much of the information in this account of the bionomics of the weevil, *Anacentrinus subnudus*, Buchanan, which attacks sugar-cane in Louisiana, has already been noticed [*R.A.E.*, A **19** 94 ; **20** 589 ; **27** 248]. It is here stated that the eggs are deposited in or round the buds, or in the rootstock of sugar-cane. Pairing occurs 3–4 days after emergence, and oviposition, which begins 6–7 days after emergence, continues throughout the life of the females. As many as 10 larval instars were observed. The eyes of stubble cane are more severely damaged by this weevil than those of standing cane, and a poor stand of stubble crop results. In the case of plant cane, injury is less severe on that planted in autumn than on that planted in spring ; cane planted in spring in an old rice-field was an almost complete loss. Preventive measures comprise the avoidance of planting sugar-cane in spring or in grassland, which should first bear a leguminous crop. None of the fertilisers normally used on cane appears to exercise any repellent or toxic action on the weevil.

A. subnudus does not occur farther north than central Louisiana, but the range of *A. deplanatus*, Csy., which appears to attack the same food-plants in Louisiana [*cf.* **20** 589], extends as far north as Washington and South Dakota.

INGRAM (J. W.), BYNUM (E. K.) & DOUGLAS (W. A.). **A Summary of Investigations on the Sugarcane Beetle in Louisiana.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 478–482. Baton Rouge, La., 1939.

Much of the information in this account of investigations in Louisiana on *Euetheola rugiceps*, Lec., the adults of which cause rather severe local damage to sugar-cane, maize and rice and which occurs throughout the southern United States, except in West Virginia and Oklahoma, has already been noticed [*R.A.E.*, A **20** 635 ; **23** 685]. Other plants attacked by the beetles include cotton and a number of grasses.

Cane injured in spring by the overwintered adults of this Dynastid generally produces suckers, but there appear to be varietal differences, depending on vigour and resistance to red rot, which follows beetle injury, in the extent to which this occurs. The percentage of plants that produced suckers varied from 48 to 76. A table shows the numbers of injured and uninjured plants of three varieties examined at harvest in 1931, 1932 and 1934, with the number and average weight of the millable canes produced by each, the weight of sugar yielded per ton of cane and per acre, and the average weight in pounds of millable cane produced per marked plant. In years of severe infestation as many as half the plants in many fields may be destroyed, and the loss of sugar-cane under these conditions is estimated to be about 20 per cent. ; besides direct loss, infestation often results in reduced yield in the succeeding ratoon crop.

The overwintered adults feed from February or March until the end of June ; females oviposit soon after starting to feed, but most eggs are deposited towards the end of the period, when many females migrate to pasture land for oviposition. During July–October, the newly emerged adults destroy the growing points of summer-planted cane, attack the buds and stalks of both summer- and autumn-planted cane, and gnaw into standing canes. This decreases the stand of cane for the following year's crop. The beetles overwinter in sod areas, especially on knolls in pasture land, and, to a less degree, in cane-fields. The numbers hibernating in various localities bear some relation to the numbers breeding there, but hibernation occurred in places where larvae were not observed.

During investigations on control measures, consignments of the Scoliid, *Campsomeris dorsata*, F., and the insectivorous toad, *Bufo marinus*, were imported from Porto Rico in 1934 and 1936, respectively, and 530 females and 9 males of the former and 100 adults of the latter were liberated, but no recoveries of either have been made. Treatments applied to rows of infested cane against the adult beetles in spring were ineffective ; they included a spray of nicotine sulphate, sprays and dusts of lime-sulphur, sodium-fluosilicate dust, tobacco dust, carbon bisulphide emulsion, calcium cyanamide, ammonium sulphate and liquid ammonia, besides some already noticed [**20** 636]. Baits containing sodium arsenite were lethal, but unattractive to the adults. Injury was reduced by catching the beetles at lights [**23** 686] on still evenings when the ground was fairly dry and the temperature had exceeded 80°F. during the day and 75°F. at 7 p.m. Clear bulbs were more attractive than red or blue bulbs of the same wattage, or red, light-blue or dark-blue neon lights. Small numbers of *Ligyrus gibbosus*, DeG., which causes similar injury to sugar-cane, were also trapped. Varying the date on which soil removed from seed-cane was returned to it and growing *Melilotus indica* on sugar-cane rows [*cf.* **23** 686] were of no value in reducing injury ; there was no difference in the amount of injury in areas in which trash left during harvesting was burned and those in which it was not.

INGRAM (J. W.), HALEY (W. E.) & CHARPENTIER (L. J.). **Insect Vectors of Sugarcane Mosaic in Continental United States.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 483–494. Baton Rouge, La., 1939.

Studies were carried out in Louisiana during 1930–38 on the relation of the abundance and habits of insect vectors of mosaic of sugar-cane to the rapidity of spread of this disease. The Aphids, *Aphis maidis*, Fitch, *Carolinaia* (*Hysteroneura*) *setariae*, Thos., and *Toxoptera graminum*, Rond., are the only known vectors in Louisiana [*R.A.E.*, A **24** 775], but the Jassid, *Draeculacephala mollipes*, Say, which is the most abundant of the Rhynchota found on cane, with the exception, in some fields, of *Pseudococcus boninsis*, Kuw., was also included in the survey.

Preliminary investigations before 1933 indicated that the percentage of the plants infested is more important in relation to the spread of mosaic than the number of insects per 100 plants. A table shows the numbers of plants of the variety Co. 281, which is considered to be the most susceptible to the disease, examined during April–July, the period when most spread occurs, during each of the years 1934–38, inclusive, together with the percentages that were infested by each of the four species, and the average percentage infestation by each species during the periods 1934–38 and 1935–38. During 1934–38, *C. setariae* was four times as abundant as *A. maidis*, and during 1935–38 *D. mollipes* was 80 times as abundant as *A. maidis* and 17 times as numerous as all the vectors combined. *A. maidis*, *T. graminum* and *D. mollipes* showed no varietal preference in adjoining plantations of Co. 281 and Co. 290, but *C. setariae* consistently preferred Co. 290, probably because the larger collar-lobe of this variety affords a greater food area and greater protection from rains ; observations indicate that this Aphid also prefers other broad-leaved varieties. There was no significant difference between the numbers of a species found on different soil types or in different situations during 1934 and 1935. There appeared to be some correlation between the abundance of ants (which attend all three Aphids) and the spread of mosaic during 1935–37, although in some fields in which the ant population was low, the disease spread considerably. Spread appeared to be more marked where *Iridomyrmex humilis*, Mayr, was present.

Insects were collected in cane-fields in 1932, 1937 and 1938 in two types of traps, which are described, in order to determine whether mass flights of the vectors, such as occur in Java [**14** 592], take place in Louisiana. All three Aphids were trapped, but there was no evidence indicating the occurrence of mass flights of any of them. In 1937, the catches indicated mass flights of two other Aphids, *Rhopalosiphum pseudobrassicae*, Davis, and *Hyalopterus arundinis*, F.

A table is given showing the prevalence of 22 wild grasses and a sedge in or near cane-fields in Louisiana during the investigation, the degree of infestation of each by each of the three vectors, and the percentages infected with mosaic (which occurred in 6 of the grasses) in infected cane fields. *A. maidis* occurred abundantly on maize and *Sorghum* as well as on the wild food-plants, and small numbers of *C. setariae* were observed on *Sorghum*.

The habits and possible importance of the three vectors are briefly described. Preliminary tests indicated that *A. maidis* is the most effective, probably because it feeds almost entirely in the central whorl of the plant. It occurs in small numbers on cane during winter and early spring, but only rarely later in the season when the various grasses that it prefers are available. It is believed that mosaic is transferred by this Aphid largely by migration in spring from infected cane to wild grasses that may be susceptible and later migration back to cane when the infected grasses are destroyed or become less attractive owing to the formation of panicles. *C. setariae*, which occurs throughout most of the United States and in Cuba and Porto Rico, appears to be the least effective vector, though owing to its abundance it is probably the most important in many fields in Louisiana. It sometimes feeds in the central whorl of cane and the larger grasses, although it generally occurs on the collar-lobe. It occurs in winter on *Andropogon virginicus* and *A. glomeratus* in and near ditches and migrates or is carried by ants to the cane in spring. It is believed to transfer mosaic chiefly from cane to cane, but some transmission occurs from grass to cane. It has been found on plum twigs in the sugar-cane section, but plum trees are comparatively rare near cane-fields.

T. graminum is of practically world-wide distribution, but has been observed to feed on sugar-cane only in Louisiana and only of recent years. It is most abundant on cane during spring and early summer and often feeds on the central whorl. It transmits mosaic from cane to cane and from grass to cane, and since crabgrass (*Digitaria sanguinalis*) is one of its preferred food-plants in Louisiana, transfer from this grass to cane is of importance. It is unevenly distributed throughout the sugar-cane section, being abundant in the lower Mississippi River area, and is generally less numerous than *A. maidis*.

Adults and nymphs of *D. mollipes* feed almost entirely on the central whorl of sugar-cane, on which it was observed throughout winter. Trials on transmission of mosaic by this species have given negative results [**24** 775], but further investigation is considered necessary. Brief notes are given on 10 other insects (Homoptera and thrips) that occur in Louisiana on cane or on wild grasses associated with cane and are possible vectors. One of these, *Carolinaia cyperi*, Ains., was a vector in experiments in Porto Rico [**25** 411].

Studies on control gave inconclusive results. Cutting the grass in 1936 caused the vectors to migrate to sugar-cane, and the new growth induced by the cutting provided new breeding grounds. When ants were controlled in experimental and check plots in 1935 the incidence of mosaic was low in both ; the poison probably affected ants and vectors over the whole area, and the experiment should be repeated with a greater distance between the treated and check plots. In preliminary experiments in 1937, the presence of growing maize did not appear to increase to any extent the spread of the disease to sugar-cane. Releases of *Hippodamia convergens*, Guér., to control Aphids in 1938 [**28** 245] were unsuccessful, chiefly because most of the Coccinellids left the plot. Dust insecticides reduced the spread of mosaic in seed-cane in some but not all experiments ; significant decreases were given by derris and pyrethrum, but not by nicotine sulphate. The best method of reducing mosaic spread in seed plots is by the selection of situations where there is little source of the disease and where there is as little spread as possible.

OCFEMIA (G. O.) & CELINO (M. S.). **Some Recent Findings regarding Fiji Disease of Sugarcane in the Philippines.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 550–554, 2 figs., 6 refs. Baton Rouge, La., 1939.

An account is given of the symptoms of Fiji disease of sugar-cane [*R.A.E.*, A **21** 520] and of recent investigations in the Philippines on its transmission by nymphs of *Perkinsiella vastatrix*, Bred. The technique employed was similar to that used in previous experiments on transmission by the adults [**22** 504]. During March–August 1937, the virus was transmitted to one-node cuttings by nymphs in the second, third, fourth and fifth instars, and the symptoms became apparent after 55–200, 67–93, 64–127 and 31 days, respectively. A greater number of successful transmissions was obtained with fifth-instar nymphs than with younger ones, and first-instar nymphs failed to transmit the virus. Between November 1936 and April 1937, four of six cane shoots, 40 days old, that were each exposed to one adult of the Delphacid developed symptoms of Fiji disease after incubation periods of 107–141 days.

In 1932–33, stalks of sugar-cane infected with mosaic produced some shoots in which the symptoms were not apparent, although they contained the virus ; in experiments carried out in 1934 with one-node cuttings infected with Fiji disease, however, all the shoots developed symptoms. Of two series of 11 one-node cuttings taken from two apparently healthy canes in February 1936 and examined at intervals until September 1937, 4 and 3 produced diseased shoots. The remaining 11 living canes were healthy and did not contain the virus, but developed the disease when exposed to infected *Perkinsiella*. It is concluded that the infected insects that attacked the canes from which the cuttings were taken fed only on the leaves and leaf-sheaths that enveloped the 7 nodes from which diseased shoots later developed, and that on reaching the node the virus did not pass up or down the stalk. One infected node produced 7 shoots of which only 3 were diseased.

Since *Perkinsiella* leaves its food-plants, if these are disturbed, and migrates to others, it spreads the disease rapidly if infected canes are destroyed while it is abundant ; this should therefore be done during April–June in the Philippines, when it is scarce or absent, and should be completed before August.

Scaramuzza (L. C.). **The Introduction of *Theresia claripalpis* V. de W. into Cuba, and its artificial Multiplication.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 589–595, 3 figs., 8 refs. Baton Rouge, La., 1939.

Lixophaga diatraeae, Tns., is the most important natural enemy of *Diatraea saccharalis*, F., on sugar-cane in Cuba, but since it is not very effective in the higher, dry parts of the Island, attempts were made to introduce *Theresia claripalpis*, Wulp, as a supplementary control. In 1934, 391 puparia of this Tachinid were received from Trinidad, and from the 295 adults that emerged a further supply was bred in the laboratory by a technique that is described. Females were placed singly 8–10 days after pairing in glass tubes, the inside walls of which had been moistened. Their wings adhered to the glass and they deposited larvae during their efforts to escape. The larvae were reared on larvae of *D. saccharalis* until they were ready to pupate. The pupal stage occupied 12–17 days, according to the temperature. Between July and December, 895 puparia in open bottles and 268 adults (males and fertilised females) were liberated in various localities, but no recoveries were made when these districts were examined in 1936. Attempts to rear the parasites on larvae of *D. lineolata*, Wlk., were unsuccessful.

A further attempt to introduce the parasite was made in 1937, but on this occasion many of the pupae from Trinidad were parasitised by *Trichopria cubensis*, Font. (a Diapriid originally described from *L. diatraeae* in Cuba [*cf.* *R.A.E.*, A **22** 186]), and one by the Pteromalid, *Spalangia drosophilae*, Ashm. Larvae of *T. claripalpis* were obtained by the method already described and also by dissecting gravid females, and were reared under improved laboratory conditions. Between May 1937 and January 1938, 550 fertilised females were released in 4 localities in Cuba, each colony containing 14–96 females and a variable number of males, but no recoveries were made when the fields were examined in August.

As a result of this work, the author considers *T. claripalpis* to be unsuited to the ecological conditions in Cuba, and this view is supported by its failure to become established in Antigua [**27** 660].

PEMBERTON (C. E.). **Quarantine Measures against Insects carried by Transpacific Airplanes.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 595–596. Baton Rouge, La., 1939.

During October 1936, a passenger aeroplane service was established between California and Manila, calling at Honolulu, Midway Island, Wake Island and Guam, and the route was later extended to Hong Kong. The flight between Manila and Honolulu usually occupies four days, including overnight stops, and during each night the doors and ports of the aircraft are opened while they are overhauled under brilliant flood-lights, which attract many insects. Before the next flight, all the openings are closed, generally early in the morning, and any insects that may have entered are unable to escape until the next port is reached ; since the periods between stops are short, many survive the journey without food or moisture. The airport at Honolulu is situated among some of the best cane-fields in Hawaii, and the introduction by aeroplane and establishment of sugar-cane pests is therefore possible. Observations at the airport indicated that many insects arrived in the aeroplanes alive.

The practice of lightly spraying the doors, windows and other accessible parts of the aeroplane shortly before landing was adopted to destroy mosquitos, but besides being necessarily superficial owing to the inconvenience caused to the passengers and crew, this measure was inadequate against many other insects. The Hawaiian Sugar Planters' Association therefore established an entomologist on Midway Island to spray the interior of each eastward-bound aeroplane during the night, after the passengers had disembarked, and the service has now been extended to include westward-bound aircraft in order to protect the Islands of Wake and Guam from introductions from Hawaii ; the number of living insects to reach Hawaii has been definitely reduced by this measure.

There are no sugar-cane pests on Midway Island, but periodical surveys are made in order that measures may be taken against any that may become established. Records are kept of the number and species of insects found in aircraft at Midway and Honolulu to serve as an indication of the species most frequently encountered, those against which precautions are particularly necessary, those that conceal themselves most successfully, and the types that tend to survive the journey and the treatment. The spray treatment cannot be entirely effective, owing to the large size of the aeroplanes and the presence of spaces, notably within the wings, that are inaccessible, but the results obtained justify its continuance.

BYNUM (E. K.), HALEY (W. E.) & CHARPENTIER (L. J.). **Sources of Infestation by the Sugarcane Borer and Trash Treatment for the Destruction of Overwintering Borers.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 597–610, 8 refs. Baton Rouge, La., 1939.

The following is based largely on the authors' summary of investigations carried out in Louisiana in 1934–38 : In addition to sugar-cane and maize, *Diatraea saccharalis*, F., attacks various wild grasses, but these are not considered to be an important source of spring infestation on the sugar-cane plantations. The wild grasses are cut two or three times a year, which prevents the culms from growing large enough to accommodate many overwintering larvae ; if the ditch banks, roadsides and other places producing large grasses were not cleared at intervals, the culms would probably be of considerable importance as hibernation shelters. The maize crop is of secondary importance on sugar-cane plantations and the grain is harvested early, usually by 15th September. The maize stalks are ploughed under, with the cover crop, and the land prepared for autumn cane planting, which is usually begun at the end of September. Maize stalks are not considered to be an important source of infestation under the conditions prevailing on sugar plantations in Louisiana.

The numbers of larvae of *D. saccharalis* that had survived the winter in cane stubble during 1934–38 varied from 4 to 76 per acre, with an average of 36 ; cane stubs therefore constitute an important source of re-infestation. Since the larvae rarely bore down the tap root far below the surface of the soil, a large percentage of the population could be prevented from overwintering by cutting the cane at ground level during harvest. Seed cane is not selected with reference to the degree of infestation in the fields from which it is taken in Louisiana, and therefore often contains large numbers of *D. saccharalis*, particularly if it is not planted until autumn. In spring, when some of the soil covering the seed cane is removed to induce the formation of suckers, enough is left (about 2 ins.) to prevent a large percentage of the moths from emerging, but the amount could be increased without reducing the stand of cane. The young shoots from summer-planted cane are large enough to attract ovipositing females, and they become heavily infested before frost occurs. They are not all killed by frost, and many larvae overwinter in them, the numbers varying from 58 to 203 per acre in four fields examined. It is considered that the population in these shoots could be greatly reduced by cutting and destroying the young growth.

Cane trash appears to be the most important source of spring infestation. The overwintering population can be greatly reduced by thoroughly burning the trash [*cf. R.A.E.*, A **22** 653 ; **27** 371]. Parasitism by *Trichogramma* was not reduced by this measure [*cf.* **22** 578, etc.].

Sasscer (E. R.). **Plant Quarantine Restrictions on the Entry of Sugarcane into the United States.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 611–616. Baton Rouge, La., 1939.

Quarantine No. 15 (foreign) and No. 16 (domestic), which became effective on 6th June 1914, prohibited the entry into the United States of sugar-cane from all foreign countries and from Porto Rico and Hawaii, respectively. Revisions made in 1934 included bagasse and other parts of the sugar-cane plant in the quarantines and prohibited the entry of cane from foreign countries into Porto Rico and Hawaii. The methods by which the quarantines are enforced are described. During the fiscal year 1938, 2,001 interceptions, consisting of 9,681 nodes and stalks of cane, were made at the various maritime and Mexican border ports of entry ; 52 interceptions, consisting of 101 nodes or pieces, were made on aeroplanes landing in Florida. A list of the chief insect pests of sugar-cane that have been intercepted is given.

Importations of living cane are made by the Bureau of Plant Industry in limited quantities. The cane is examined by entomological and pathological inspectors at Washington, D.C., and, after being immersed in water at 122°F. for 15 minutes, is sent to the quarantine greenhouse in Virginia, where cuttings (about 4 ins. long and with the leaf sheaths removed from the nodes) are dipped in 95 per cent. alcohol, immersed in a solution of mercury bichloride (1 : 1,000) for 10 minutes, and then planted in cans in an insect-proof compartment. Any plants that develop abnormalities or symptoms of disease are isolated for observation. If no diseases or insects have appeared by the time that the plants are 8–12 ft. high, cuttings are taken from them and these, after being subjected to the same treatment as the original ones, are planted in another compartment. If the resulting plants grow normally, cuttings are taken from the mature stalks, and after receiving the hot-water and sterilisation treatments already described, are sent to the field stations. As a preliminary to these importations, it is the practice to send specific instructions regarding the selection of the cuttings and to suggest that they be inspected prior to shipment by qualified entomologists and pathologists.

Considerable interest has been shown in the importation of bagasse into the United States, and observations made at the mills and inspection of the product at the time of entry have thus far confirmed the belief that the risk of introducing insect pests with it is negligible, owing to the methods employed in dry milling and the application of hot maceration water. It is, however, a potential source of certain disease organisms, and permits for its importation are therefore issued only under specified conditions.

ELLISOR (L. O.) & INGRAM (J. W.). **Experiments with Insecticides in the Control of the Sugarcane Borer,** *Diatraea saccharalis* (**Fab.**).—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 693–705, 3 refs. Baton Rouge, La., 1939.

Though satisfactory insecticides would probably be too costly to use on a commercial scale against *Diatraea saccharalis*, F., on sugar-cane, they might prove of value in cases of severe local infestation. Field investigations with various proprietary dusts were therefore carried out in Louisiana during the autumn of 1937 and the spring of 1938. Those tested comprised synthetic and natural cryolite, which contained 87·1 and 90 per cent. sodium fluoaluminate, respectively, dusting cryolite, which contained 31·7 per cent., most of the impurity being carbon, a mixture, containing 33 per cent. arsenic pentoxide, of a basic calcium arsenate and about 8 per cent. basic copper sulphate, and a dual-fixed nicotine (composed of nicotine tannate and nicotine bentonite and containing 3·75 per cent. nicotine). The three cryolites were neutral in reaction. In all tests, the applications were made at intervals of about a week.

The following is based largely on the authors' summary : Synthetic and natural cryolite, applied from 2nd September to 18th November at an approximate rate of 10 lb. per acre, both reduced injury by *D. saccharalis* by approximately 90 per cent. on cane that had been planted in August of the same year. No control was given by the mixture of calcium arsenate and copper sulphate. When the dusts were applied between 14th April and 28th June 1938 at the rate of 10–12 lb. per acre, synthetic cryolite reduced injury by larvae of the first and second generations by about 93 and 90 per cent., respectively. Dusting cryolite and a mixture of equal parts of synthetic cryolite and talc each reduced damage by larvae of the first and second generations by about 80 and 60 per cent. The dual-fixed nicotine was ineffective.

Two applications of synthetic cryolite, dusting cryolite and the mixture of cryolite and talc at the approximate rate of 10 lb. per acre when first-generation larvae were abundant reduced damage by 42, 25 and 34 per cent., respectively, and four applications at the same rate made when second-generation larvae were abundant reduced it by 50–55 per cent. Four applications of synthetic cryolite at the rate of 6–8 lb. per acre made between 7th June and 28th July reduced damage by the larvae of the second generation by about 60 per cent.

None of the dusts was effective after the larvae had begun to tunnel into the plants. Those containing cryolite were not injurious to the foliage, but in 1937 both natural and synthetic cryolite caused slight scorching on the leaf-sheaths, which, however, had no appreciable effect on the growth of the plants.

IWATA (K.). **Habits of** *Rhinonitela domestica* **Williams, a minute Booklouse-hunter in Formosa.**—*Mushi* **12** no. 1 pp. 13–16, 13 refs. Fukuoka, 1939.

Notes are given on the habits and nests of the Sphegid, *Rhinonitela domestica*, Williams, females of which were observed in a house in Formosa in April 1937 to be predacious on immature Psocids, which they carried to their nests as food for the larvae.

TAKAHASHI (R.). **Some Coccidae from Formosa and Japan (Homoptera), IV.**—*Mushi* **12** no. 2 pp. 86–89, 2 figs. Fukuoka, 1939.

A description is given of the adult female of *Pseudococcus chiponensis*, sp. n., which was found in 1938 in a fungus densely covering the roots of *Citrus* in Formosa. *Aonidiella inornata*, McKenzie, was collected on papaya in Formosa in 1938. Both it and *A. taxus*, Leon. [*cf. R.A.E.*, A **25** 513], which sometimes occurs in abundance on imported *Podocarpus macrophylla*, but not on native *Podocarpus* in the mountainous regions, have been confused with *A. aurantii*, Mask., which is very common on *Citrus* and other cultivated and wild plants in the lowlands and in the mountainous regions of Formosa. *Leucodiaspis* (*Leucaspis*) *hydrangeae*, Takahashi, which was previously known only from *Hydrangea*, was observed in 1938 attacking the leaves and twigs of *Liquidambar formosana* in Formosa.

AOKI (Y.) & FUJISHIMA (H.). **Studies concerning** *Dacus dorsalis* **Hendel.** [*In Japanese.*]—52 pp., 10 pls. Saipan, Inst. trop. Indust., 1939.

In the Japanese Mandated Islands, *Dacus ferrugineus dorsalis*, Hend., oviposits in ripe, but not unripe, fruits of mango, papaya and banana. In breeding experiments in which the host fruit was mango, the egg, larval, pupal and adult stages averaged 28, 277, 218 and 516 hours, respectively.

Papers noticed by Title only.

Bondar (G.). **A formiga saúva e sua extinção.** [Leaf-cutting Ants (*Atta* spp.) and their Control in Brazil.]—*Bol. Inst. cent. Fom. econ. Bahia* no. 7, 10 pp., 1 pl. Bahia, 1938. [Recd. 1939.] [*Cf. R.A.E.*, A **23** 749; **26** 533.]

Takahashi (R.). **A new Scale Insect** [*Coccus kuraruensis*, sp. n.] **attacking Lemon in Formosa.**—*Trans. nat. Hist. Soc. Formosa* **29** no. 195 pp. 314–316, 2 figs. Taihoku, 1939.

Yamasaki (M.) & Arikado (H.). **The Cell-sap Concentration of Sugarcane Varieties in Relation to their Resistance to the Attack of the White Leaf Louse** [*Oregma lanigera*, Zehnt., in Formosa].—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 475–478, 2 refs. Baton Rouge, La., 1939. [*Cf. R.A.E.*, A **27** 444.]

Mathes (R.), Ingram (J. W.) & Haley (W. E.). **Preliminary Report on Studies of Progenies of Sugarcane Crosses for Susceptibility to Sugarcane Borer** [*Diatraea saccharalis*, F.] **Injury in Louisiana.**—*Proc. int. Soc. Sug. Cane Tech.* **6** pp. 581–589, 1 ref. Baton Rouge, La., 1939.

Johnson (J. P.). **Control of the Japanese Beetle** [*Popillia japonica*, Newm., in Connecticut].—*Circ. Conn. agric. Exp. Sta.* no. 132, 14 pp., 7 figs. New Haven, Conn., 1939. [*Cf. R.A.E.*, A **26** 726–727].

Lanchester (H. P.). **The External Anatomy of the Larva of the Pacific Coast Wireworm** [*Pheletes canus*, Lec.].—*Tech. Bull. U.S. Dep. Agric.* no. 693, 40 pp., 7 figs., 22 refs. Washington, D.C., 1939.

Gibson (A.). **The Canadian Entomological Service. Fifty Years of Retrospect, 1887 to 1937** [including notes on important insect pests].—*Verh. 7 int. Kongr. Ent., Berlin 1938* **3** pp. 1429–1479, many refs. Weimar, 1939.

Petch (T.). **Notes on Entomogenous Fungi** [including new species].—*Trans. Brit. mycol. Soc.* **23** pt. 2 pp. 127–148, 8 figs. London, 1939.

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Goodhue (L. D.) & Haller (H. L.). **Crystalline Solvates of inactive Deguelin.**—*J. Amer. chem. Soc.* **61** no. 2 pp. 486–488, 9 refs. Easton, Pa., 1939.

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Markwood (L. N.). **The photometric Determination of Nicotine on Apples, without Distillation.**—*J. Ass. off. agric. Chem.* **22** no. 2 pp. 427–436, 1 fig., 12 refs. Washington, D.C., 1939.

Cassil (C. C.) & Wichmann (H. J.). **A rapid volumetric micro method for determining Arsenic.**—*J. Ass. off. agric. Chem.* **22** no. 2 pp. 436–445, 3 figs., 7 refs. Washington, D.C., 1939.

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